

A REVISION OF THE BORAGINACEAE OF WEST PAKISTAN AND KASHMIR *

S. M. A. KAZMI

8. *Pseudomertensia* Riedl in Rechinger, Fl. Iranica 48: 58. 1967.

Oreocharis (Decne.) Lindl. Veg. Kingd. 656. 1848, *non* Benth. 1876, *pro parte*.
Lithospermum L. subgen. *Oreocharis* Decne. in Jacquem. Voy. Inde Bot.
122. 1844, *pro parte*.

Eritrichium Schrad. sect. *Oreocharis* (Decne.) DC. Prodr. 10: 123. 1846, *pro parte*.

Mertensia auct. fl. asiatica *pro parte* — *non* Roth, Catalecta 1: 34. 1797.

TYPE SPECIES: *Lithospermum elongatum* Decne.

Perennial, strigose or softly hairy herbs. Leaves usually alternate. Racemes terminal, scorpioid, usually simple, dense or lax, ebracteate. Flowers blue to purplish-blue, pedicellate. Sepals narrow, sometimes enlarged in fruit. Corolla campanulate, cylindrical-campanulate, or hypocrateriform; tube as long as, or much longer than the calyx; throat with or without appendages; lobes 5, imbricate in bud, short, spreading or erect. Stamens 5, included or exserted from the corolla tube; filaments very short to very long; anthers oblong, obtuse, or rarely acute. Ovary 4-lobed, style filiform, stigma capitate, small. Nutlets 4, erect, ovoid-oblong, dorsally slightly convex, ventrally carinate, slightly angular, margins often acute; areola distinct, sub-basal, oblique, affixed to the short pyramidal gynobase.

Species 11 to 12, distributed in Western Himalayas from Afghanistan to Nepal.

KEY TO THE SPECIES

- a. Anthers exserted from the corolla tube, filaments 2–5 mm. long.
 - b. Corolla more or less equalling the calyx; corolla lobes up to 1.5 mm. long, faucal appendages absent. 1. *P. parviflora*.
 - b. Corolla much exceeding the calyx; corolla lobes 2.5–3 mm. long; faucal appendages present. 2. *P. trollii*.
- a. Anthers included or little exserted from the corolla tube; filaments less than 2 mm. long.
 - c. Faucal appendages absent.
 - d. Corolla not constricted at the throat; internally with minute pubescence instead of faucal appendages; filaments 2 mm. long. 3. *P. eforficata*.
 - d. Corolla constricted at the throat, internally glabrous; filaments hardly up to 0.5 mm. long. 4. *P. echioides*.
 - c. Faucal appendages present, poorly to well developed.

* Continued from volume 51, p. 184.

- e. Corolla campanulate. 5. *P. elongata*.
- e. Corolla not campanulate; distinctly cylindrical or infundibuliform.
 - f. Faucal appendages longer than broad.
 - g. Faucal appendages 2–3 mm. long, 1–1.5 mm. broad at the base, triangular, ciliate at the margins. 6. *P. drummondii*.
 - g. Faucal appendages 0.8–1.2 mm. long, 0.5 mm. broad at the base, lingulate, not ciliate at the margins. 7. *P. chitralensis*.
 - f. Faucal appendages broader than long.
 - h. Filaments usually longer, rarely equalling the anthers in length. 8. *P. anjumiae*.
 - h. Filaments always shorter than the length of anthers.
 - i. Leaves, including petioles, 40–160 mm. long, 10–45 mm. broad; corolla tube twice as long as the calyx, anthers up to 1 mm. long. 9. *P. nemorosa*.
 - i. Leaves, including petioles, 15–80 mm. long, 2–10 mm. broad; corolla tube three to five times as long as the calyx; anthers 1–1.7 mm. long. 10. *P. moltkioides*.

1. *P. parviflora* (Decne.) Riedl in Rechinger, Fl. Iranica 48: 60. 1967.

Craniospermum parviflorum Decne. in Jacquem. Voy. Inde Bot. 1: 126. *t.* 130. 1844.

Moltkia parviflora (Decne.) C. B. Clarke in Hook. f. Fl. Brit. India 4: 171. 1883.

Mertensia exserta I. M. Johnston, Jour. Arnold Arb. 37: 305. 1956; R. R. Stewart, Biologia 13: 93. 1967.

TYPE: In summis pascuis à Ilahabad ad Hyderabad trans jugum Pir-penjal, 2681 m., *Jacquemont s.n.* (P).

ICON.: Jacquemont, l. c. *t.* 130. 1844.

Perennial with stout woody underground rhizomes; emerging shoots many, suberect or sometimes trailing, 6–15(–25) cm. long, clothed with short appressed trichomes. Basal leaves short petiolate, linear-oblong, entire, obtuse or subacute, 40–50 mm. long, 4–6 mm. broad, covered on both surfaces with short, appressed trichomes; cauline leaves mostly sessile, shorter and narrower, acutish. Inflorescence usually forked, sometimes simple, short and scorpioid when young, later elongated, curved, 2–6 cm. long. Calyx divided to the base, lobes narrow oblong, 2.5–3 mm. long, densely hairy on the lower parts and margins, obtusish, in fruits slightly enlarged; pedicels 1–4 mm. long. Corolla 2.5–3 mm. long, more or less equalling the calyx, cylindrical, glabrous, tube 2–2.5 mm. long, lobes 0.5–1(–1.5) mm. long, 0.5–0.8 mm. broad at base, erect. Stamens much exserted from the corolla tube; anthers obtusish, elliptic, 0.5–0.6 mm. long, versatile; filaments up to 3 mm. long, inserted about 2.5 mm. above the corolla base. Style 6 mm. long, stigma minute, subcapitate. Nutlets ovoid-oblong, acute, smooth, shining, ca. 2 mm. long.

DISTRIBUTION: West Pakistan, Kashmir.

West Pakistan: CHITRAL STATE: Ziarat, Lowari Pass, 2600 m., *Stainton* 2337 (BM). HAZARA DIST.: Pipe line, Changlagali, 2500–3000 m., *Dickason* 83

(MICH); between Dungagali and Changlagali, 2500–3000 m., *Kazmi 746a* (PES); Nathiagali, 2700 m., *Kazmi 84b* (PES). KURRAM AGENCY: Kurram Valley, *Afandi 404* (PES); Ziran, *Kazmi 207a* (PES); Shalozan, *Kazmi s.n.* (PES), *Afandi s.n.* (PES); Kaiwas & Shendtoi, 2700–3000 m., *Aitchison 397* (GH). RAWALPINDI DIST.: Murree Hills, 2300 m., *R. R. Stewart 12559* (GH), *Asghar Ali, s.n.* (MICH); Patriata Forest, *Kazmi 4c* (PES); Murree, Kashmir Point, *Kazmi 2480* (PES); Upper Topa, *Kazmi 2487* (PES).

Kashmir: Poonch, Trarkhel, 2000 m., *R. R. Stewart 12084* (GH); Gulmarg, *Aitchison 74* (K), *Keshawanand 1162* (GH), *Trotter 110* (BM); Basin of Chenab, *Thomson* (4. 5. 1848) *s.n.* (K); near Avantipura, *Thomson* (4. 5. 1848) *s.n.* (K); Lidder Valley, Kinimola Nulla, *Inayat 25705* (K). Miscellaneous: 5000–7000 ped., Herb. Ind. Orient. Hook. f. & Thoms., *Thomson s.n.* (GH).

2. *P. trollii* (Melch.) Stewart & Kazmi, comb. nov.

Mertensia coventryana S. Clay, The Present Rock Garden 20: 379. t. 27a. 1937, *nomen nudum*.

Moltkia trollii Melch. Notizbl. Bot. Gart. Berlin 15(1): 115. 1940.

Mertensia trollii (Melch.) I. M. Johnston, Jour. Arnold Arb. 37: 303. 1956; Riedl in Køie & Rechinger, Biol. Skr. 13(4): 227. 1963.

TYPE: Kashmir: Tragbal Pass, in der Nadelwaldregionen mit *Pinus*, *Picea* und *Abies*, 3000 m., Blüten hellblau, *C. Troll 7028* (B).

ICON.: S. Clay, l. c. t. 27a. 1937, under *Mertensia coventryana*.

Perennial with underground branched rhizomes to 20 cm. long; emerging shoots usually curved, sometimes erect, to 10 cm. tall, clothed with short, thick, white, appressed trichomes. Basal leaves including petioles 4–6 cm. long, 4–18 mm. broad, lamina elliptic or elliptic-oblong, entire, apices obtuse, glandular, nerves prominent below, at the base gradually attenuated into long petioles, more or less ciliate at margins, broad at the base; both surfaces covered with short, white, appressed trichomes, cauline leaves oblong to oblong-lanceolate, shorter, narrower, sessile to subsessile. Inflorescence terminal, usually solitary, contracted, scorpioid, 1–3 cm. long. Calyx shorter or equal to the corolla tube, divided to the base, lobes linear-oblong, acute, densely hairy on the margins, few scattered trichomes externally, marginal trichomes 0.5–0.8 mm. long and antrorsely spreading; pedicels 1–3 mm. long. Corolla sky-blue to dark purplish-blue, 7–8 mm. long, glabrous, tube cylindrical ca. 5 mm. long, lobes oblong, 2.5–3 mm. long, ca. 1.8 mm. broad at the base, subpatent; faucal appendages 0.5 mm. long and broad. Stamens exserted from the corolla tube to exceeding the corolla lobes; anthers versatile, elliptic, obtuse, 1–1.5 mm. long; filaments 2.5–5 mm. long, slightly narrowed at the apices, inserted at the level of the faucal appendages, about 4 mm. above the corolla base; style filiform, equalling or shorter or little exceeding the stamens; stigma minute, subcapitate.

This species is closely related to *Pseudomertensia parviflora* in having stamens conspicuously exserted from the corolla tube, but differs from it in having a much longer corolla with well developed lobes and five in-

vaginated hemispheric appendages in the throat. The corolla lobes in *P. trollii* are oblong or elliptic, 2.5–3 mm. long and clearly exceeding the calyx lobes, while those of *P. parviflora* are more or less triangular and usually 1–1.5 mm. long.

The length of calyx, corolla, filaments, and anthers is very variable in *Pseudomertensia trollii* and the three following varieties may easily be distinguished.

KEY TO THE VARIETIES

- a. Calyx about $\frac{2}{3}$ the length of corolla tube; corolla 9–11(–12) mm. long. 2c. var. *edelbergii*.
- a. Calyx usually equal to the corolla tube; corolla up to 8 mm. long.
 - b. Anthers 1 mm. long; filaments 4–5 mm. long; faucal appendages well developed. 2a. var. *trollii*.
 - b. Anthers 1–1.5 mm. long; filaments ca. 2 mm. long; faucal appendages poorly developed. 2b. var. *harrissii*.

2a. Var. *trollii*.

Basal leaves narrower and with short petioles compared to var. *edelbergii*; calyx more or less equal to the corolla tube; corolla up to 8 mm. long, lobes acutish; anthers 1 mm. long; filaments 4–5 mm. long.

DISTRIBUTION OF VAR.: West Pakistan, Kashmir.

West Pakistan: GILGIT AGENCY: On Indus river near Rondu, E–W. of Skardu, about 40 miles, *Thomson* (18.3.1848) s.n. (K); Gurais, *Mrs. Earl* in *R. R. Stewart* 1258 (GH). HAZARA DIST.: Kaghan Valley, Bhimbal, 2300 m., *Duthie* 19486/a (K); Batakundi, 2700 m., *Champion* (13.5.1927) s.n. (GH); *Kazmi* s.n. (PES).

Kashmir: Tragbal Pass, 3000 m., *Troll* 7028 (B-type); Kajnag range, *Duthie* 11073 (E); Banihal Pass, 3000 m., *Coventry* 1448 (BM); Pahlgam, 3000 m., *Miss Ward* 116 (BM).

2b. Var. *harrissii* Kazmi, var. nov.

TYPE: West Pakistan: Dir, *Harriss* 16397 (GH-holotype).

Folia basalia ad var. *trollium* similia; tubum calycis corollae plus minusve aequans; corolla usque ad 8 mm. longa, lobi aliquot obtusi; antherae 1–1.5 mm. longae; filamenta 2.5 mm. longa.

DISTRIBUTION OF VAR.: West Pakistan.

West Pakistan: DIR STATE: Dir, *Harriss* 16397 (GH-type). HAZARA DIST.: Naran, near the Ganji Pahari top, 3000 m., *Kazmi* 2218b (PES); Saiful Maluk Sar, *D. McVean* (June 1960) s.n. (E); between Dadar and Kaghan (probably at Shahid Pani ?), *Inayat* 22006 (K).

2c. Var. *edelbergii* (Rech. f. & Riedl) Kazmi, comb. nov.

Mertensia edelbergii Rech. f. & Riedl in Køie & Rechinger, Biol. Skr. 13(4): 230. t. 176, 177. 1963.

Pseudomertensia edelbergii (Rech. f. & Riedl) Riedl in Rechinger, Fl. Iranica 48: 60. 1967.

TYPE: Afghanistan: Nuristan: Pashki, 2300 m., *Edelberg 630* (w-holotype, c-isotype).

ICON.: Riedl l. c. t. 176, 177. 1963.

Basal leaves broader with longer petioles as compared to the other two varieties; calyx about $2/3$ the length of the corolla tube; corolla 9–11 (–12) mm. long; anthers ca. 1 mm. long; filament 2.5 mm. long.

DISTRIBUTION OF VAR.: West Pakistan, Afghanistan.

West Pakistan: SWAT STATE: Kalam, 3000 m., *Kazmi 2468* (PES); Indus Kohistan, beyond Ushu, 3200 m., *Kazmi s.n.* (PES); Kalam mountain, S-E. of village, upper section of hill above 'alp' rocks, near ridge, flowers deep blue fading to deep pink, 3000–3200 m., *Lamond 1841* (E); *Lamond* in *Rechinger 30854* (w).

Rechinger and Riedl (l. c. 1963) in their original description of *Pseudomertensia edelbergii* gave the length of the corolla as 9–11 (–12) mm.; later Riedl (l. c. 1967) cited the length of the corolla as 7–8 mm. which is the length of the corollas in varieties *trollii* and *harrissii*. In all the specimens of var. *edelbergii* cited above, the length of the corolla is definitely more than 8 mm. Also, the original description of *P. edelbergii* does not indicate the length of the filaments, which was measured by me to be more or less 2.5 mm., much shorter than the length of the filaments of *P. trollii*, but almost the same as in var. *harrissii*, from which var. *edelbergii* differs in having a shorter calyx in comparison with the length of the corolla tube, as well as shorter anthers and larger leaves. Both var. *edelbergii* and var. *harrissii* differ from the typical variety in the length of the filaments which varies between 4 and 5 mm. Because the length of the filaments in the *P. trollii* complex is not very constant, and since var. *harrissii* represents an intermediate form between *P. edelbergii* and *P. trollii*, I consider all three taxa as only varieties of *P. trollii*.

3. *P. eformicata* (Rech. f. & Riedl) Riedl in Rechinger, Fl. Iranica 48: 60. 1967.

Mertensia eformicata Rech. f. & Riedl in Køie & Rechinger, Biol. Skr. 13(4): 231. 1963.

TYPE: Chitral, Drosh, 11500 ft., *Bowes Lyon 186* (BM).

ICON.: Riedl, l. c. 232. fig. 178. 1963, under *Mertensia eformicata*.

Perennial; rhizomes stout, long, more or less 1 cm. thick, branched, branches short, underground; emerging shoots many, 18–25 cm. long, erect, simple, or in the upper parts, bifurcate, covered loosely with patent to subappressed trichomes. Basal leaves lanceolate to oblong lanceolate, apices apiculate, attenuated at the base into petioles, including the petioles 5–12 cm. long, 7–18 mm. broad, on the lower surface thickly,

on the upper surface loosely covered with short trichomes; upper leaves few, attenuated towards the base, sessile, 2–4 cm. long, 3–8 mm. broad. Inflorescence solitary, short when young, later elongated up to 10 cm., bearing many distant pedicellate flowers; pedicels 3–5 mm. long. Calyx divided to the base, lobes linear, acute, \pm 5 mm. long, 0.5–0.7 mm. broad, loosely covered with subappressed short trichomes. Corolla 10–11 mm. long, cylindrical-campanulate, glabrous externally, minutely hairy internally in the throat in place of faucal appendages, throat not constricted, lobes and tube not distinct, lobes ovate to roundish, 2–2.5 mm. broad. Anthers \pm 1.5 mm. long, sagittate, acute, slightly exceeding the sinuses between the corolla lobes; filaments filiform, 2 mm. long, attached 5–6 mm. above the corolla base. Style filiform, equalling or slightly exceeding the corolla; stigma capitate.

DISTRIBUTION: West Pakistan.

West Pakistan: CHITRAL STATE: Drosh, Painogh, 3500 m. (13. 7. 1958), *Bowes Lyon* 186 (BM).

The absence of faucal appendages brings *P. efornicata* very close to *P. echioides* but the presence of pubescence in place of them distinguishes this species from the latter. In *P. echioides* the anthers are subsessile or the filaments never exceed the length of 0.5 mm., whereas in *P. efornicata* filaments are about 2 mm. and always longer than the anthers.

4. *P. echioides* (Benth.) Riedl in Rechinger, Fl. Iranica 48: 62. 1967.

Lithospermum echioides Benth. in Royle, Illustr. Bot. Himal. Mount. 1: 305. 1839; DC. Prodr. 10: 63. 1846.

Lithospermum secundiflorum Decne. in Jacquem. Voy. Inde Bot. 120. 1844.

Eritrichium secundiflorum (Decne.) A. DC. Prodr. 10: 124. 1846.

Mertensia echioides (Benth.) Benth. & Hook. f. Gen. Pl. 2: 857. 1873; C. B. Clarke in Hook. f. Fl. Brit. India 4: 170. 1883; Riedl in Køie & Rechinger, Biol. Skr. 13(4): 229. 1963.

Mertensia secundiflora (Decne.) Brand, Pflanzenr. IV. 252(Heft 97): 200. 1931.

Mertensia strigosa Melch. Notizbl. Bot. Gart. Berlin 15: 113. 1940, *syn. nov.*

TYPE: Soongnum in Kunawar-Kherang Pass, *R. Inglis s.n.* (K).

ICON.: Riedl, l. c. fig. 175. 1963, under *Mertensia echioides*.

Perennial with long underground rhizome. Emerging shoots usually erect, sometimes decumbent or curved, 5–20 cm. long, clothed with short usually spreading, rarely appressed, thin trichomes. Basal leaves including long petioles (25–)40–90(–150) mm. long, (5–)10–15(–25) mm. broad; lamina ovate, elliptic-lanceolate or lanceolate, usually acute, sometimes obtuse, margins entire, covered on both surfaces thinly or densely, and at the margins with longer, up to 1 mm. long trichomes, arising from tuberculate bases and sometimes curved at their tips; upper cauline leaves few, shorter and narrower, sessile. Inflorescence short and scor-

pioid when young, later elongated up to 13 cm., lax, bearing 10–20 subsessile pedicellate flowers to 10 mm. apart; pedicels up to 3 mm. long. Calyx divided to the base, lobes linear, \pm obtuse, erect, 4–5 mm. long, 0.5 mm. broad at base. Corolla blue to deep purple-blue, subcylindrical to funnel-shaped, glabrous, bearing few trichomes at the sinuses between the lobes; corolla tube 4.5–6 mm. long, slightly dilated above; lobes usually 3–4.5 mm., sometimes even longer, 1.5 mm. broad; faucal appendages absent. Anthers oblong, acute or rarely emarginate at the apices, usually emarginate or roundish at base, 1.5–1.9 mm. long exserted from the corolla tube, sometimes anther tips reaching half the length of the corolla lobes; filaments not more than 0.5 mm. long, thick, attached 4.5–5.5 mm. above the corolla base. Style 10–12(–15) mm. long, filiform; stigma capitate. Nutlets ovoid-trigonal, acute, pubescent on ridges, 1.8–2.5 mm. long, 1–1.5 mm. broad.

DISTRIBUTION: West Pakistan, Kashmir, and India.

Most authors have placed *Pseudomertensia echioides* with the species having faucal appendages and have distinguished it from those species because the appendages are less developed and the anthers are exserted from the corolla tube. With these characters it becomes sometimes quite difficult to distinguish *P. echioides* from the allied species, which have faucal appendages at various stages of development and anthers usually exserted from the corolla tube. In the specimens, including the type, which I have examined, I found that *P. echioides* has no faucal appendages, and if very rarely these are present, they are in indistinct traces. Anthers are subsessile and the filaments never exceed 0.5 mm. in length; filaments are thick and dilated at the base. These characters are well correlated with the long (1.5–1.9 mm.) anthers, usually acute at their apices, with usually slightly produced connectives and with the presence of trichomes at the sinuses between the corolla lobes. The presence of trichomes at the sinuses is not found in any other species of our area.

The size and form of the leaves of *Pseudomertensia echioides* are very variable and two varieties may be distinguished easily.

4a. Var. *echioides*.

Shoots few, not profusely leafy, leaves thick, usually oblong-lanceolate, up to 1.5 cm. broad, densely covered with trichomes; inflorescence more compact and less hairy in comparison to var. *lahulensis*.

DISTRIBUTION OF VAR.: West Pakistan, Kashmir.

West Pakistan: GILGIT AGENCY: Astor valley, Kalapani, Kamrinala, *Inayat* 25708 (K); Shankargarh above Astor village, *Giles* 66 (K); Astor to Degru, *Conway* 334 (K); Upper Shingu valley, Deosai region, 3000 m., *R. R. Stewart* 22231 (GH); Baltistan, Satpara Nullah, 3000 m., *Webster & Nasir* 6356 (GH), 3500 m., *R. R. Stewart* 20244 (GH, MICH, US), 3000 m., *Siddiqui, Nasir & Zaffar Ali* 4231 (BM, RAW), *Duthie* (12. 7. 1892) s.n. (BM); Nathar waterfall,

R. R. Stewart 26343 (RAW); near Skardu, 2300–2500 m., *Schlagintweit* 794 (BM); Marpu Nullah, above Dras, 4000 m., *Duthie* (3. 7. 1892) s.n. (BM); Burja La, 4000 m., *C. B. Clarke* 29930 (BM, K).

Kashmir: Shakkar, Rangdum, 4000 m., *Koelz* 5969 (GH, MICH, US); Barnaj Nullah, near Sapphire Mines, Kishtwar, 3500 m., *Ludlow & Sherriff*, 9181 (GH); Suru valley, N. of Srinagar, 4000 m., *Osmaston* 212 (K); **LADAKH:** Hanu Yegma via Handamir up to Chorbat La Pass (Pass between the Indus valley and the Shayek valley), *Schlagintweit* 6511 (US). Miscellaneous: Hab. Himal. Bor. Occ., 5000–6000 ped., Herb. Ind. Or. Hook. f. & Thoms., *Thomson* s.n. (BM, GH, US), *Falconer* s.n. (GH).

Mertensia strigosa Melch. agrees in all its details with *Pseudomertensia echiioides* var. *echiioides* and represents only a more densely pubescent form of the variety.

4b. *Var. lahulensis* (Brand) Kazmi, comb. nov.

Lindelophia lahulensis Brand, Repert. Sp. Nov. 19: 70. 1923.

TYPE: Lahul: Kyelang, an Felsen des Nyimephed, 4200 bis 4400 m. U.M., im Juli, 1880, *Heyde* s.n. (ZI — Herb. Bernhard Lorenz).

Shoots many, profusely leafy, leaves thin, usually ovate to ovate-lanceolate, more than 1.5 cm. broad, loosely covered with trichomes; inflorescence lax; fruits more hairy than in var. *echiioides*.

DISTRIBUTION OF VAR.: INDIA (Lahul): Kyelang, *Koelz* 470, 5183, 8408 (GH, MICH, US).

5. *P. elongata* (Decne.) Riedl in Rechinger, Fl. Iranica 48: 61. 1967.

Lithospermum elongatum Decne. in Jacquem. Voy. Inde Bot. 121. 1844.

Mertensia elongata (Decne.) Benth. & Hook. f. Gen. Pl. 2: 857. 1873; C. B. Clarke in Hook. f. Fl. Brit. India 4: 173. 1883.

Eritrichium elongatum (Decne.) A. DC. in DC. Prodr. 10: 124. 1846.

TYPE: KASHMIR: Supra Pendjegram, 2600 m., Aug. 21, 1831. *Jacquemont* s.n. (GH, P).

ICON.: Jacquemont, l. c. t. 126. 1844.

Perennial with underground rhizomes 10–15 cm. long and 0.5 cm. thick. Emerging shoots simple, greenish-white, erect, 10–25(–30) cm. tall, covered densely with antrorse, appressed to subappressed, white, trichomes up to 0.7 mm. long, rarely longer. Basal leaves petiolate; petioles up to 30 mm. long, margins ciliate, base broad, clasping the shoots; lamina oblong to oblong-lanceolate, narrowed at both ends, entire, acute, 15–50 mm. long, 6–8 mm. broad, covered on both surfaces, below comparatively densely, with thin appressed trichomes, usually arising from minute tuberculate bases; middle cauline leaves sessile or subsessile, to 70 mm. long, and 12 mm. broad; upper cauline leaves sessile and shorter than the middle ones. Inflorescence solitary, short and scorpioid when young, later elongated, 2–6(–9) cm. long, bearing 5–15 closely set (to 6 mm.

distant) flowers; pedicels of the lower fruits up to 6 mm. long, gradually decreasing in size upwards, hairy. Calyx 3–5(–5.5) mm. long, divided to the base, lobes linear, acute, erect, up to 0.5 mm. broad, covered sparsely dorsally and densely at the margins with thin, white, sub-appressed or rarely patent trichomes. Corolla blue, bluish-purple, or deep blue, campanulate, (6–)7–9(–9.5) mm. long, glabrous, tube equal or slightly longer than the calyx, gradually extended from the base; lobes roundish, patent, 2.5–3.5 mm. long and 2–3 mm. broad at the base; faucal appendages poorly to well developed, 3–3.5 mm. above the corolla base, the area above the appendages usually puberulous. Anthers 1.5–2 mm. long, oblong, acute, emarginate at bases, 1.5–2 mm. long; filaments 0.5–1.5 mm. long, thick, attached 2.5–3.5 mm. above the corolla base. Nutlets 4, glabrous, smooth, shining, acute, ovoid-trigonal, pallid, 2.5 mm. long, 1.5–1.6 mm. broad.

DISTRIBUTION: West Pakistan, Kashmir.

West Pakistan: CHITRAL STATE: Shishi Kuh, 2700 m., *Harriss s.n.* (BM). GILGIT AGENCY: Babusar village, 4200 m., *Siddiqui 2727a* (MICH).

Kashmir: East of Pirpanjal, above Tilpatra forests near Rampur, Jhelum valley, 3500–4000 m., *Ludlow & Sherrieff 7754* (BM, GH); Rajdhiangan Pass, 3500–4000 m., *R. R. Stewart 17974* (GH, MICH, US), *22556b* (GH), *19292* (GH); Tragbal, 3300 m., *R. R. Stewart 4800* (MICH), *Koelz 9167* (GH); Poonch, near Bantara Gali, 2700 m., *R. R. Stewart & Nasir 24084* (BM); above Gulmarg, *R. R. Stewart 10419*, *8752* (GH); Haramukh, *Ludlow & Sherrieff 7870* (GH). Miscellaneous: Herb. East Ind. Co., *Falconer s.n.* (K); *Kohli 21*(K).

6. *P. drummondii* Kazmi, sp. nov.

TYPE: Kashmir: Pir Panjal (south side), 11,000 ft., June 27, 1902, *Mr. J. R. Drummond 13919* (E-holotype).

Herba perennis, rhizomatibus horizontalibus subterraneis. Surculi emergentes simplices, erecti vel suberecti, ad 20 cm. alti, dense vel laxe pilis albis, plus minusve crispatis, patentibus, ad 1 mm. longis vestiti. Folia basalia et inferiora petiolata, petioli 10–20 mm. longi, alati, hirsuti, ad basim dilatati, lamina ad 45 mm. longa et 15 mm. lata, late lanceolata, obtusa vel subacuta, supra infraque pilis albis ad 1 mm. longis, plerumque patentibus vel subappressis vestita; folia caulina mediana et superiora ad folia inferiora similia, sessilia, sursum decrescentia. Inflorescentia terminalis, simplex vel bifurcata, 5–9-florae, in juventute brevis et scorpioidea, demum elongata; pedicelli desunt vel ad 1.5 mm. longi. Calyx ad basim divisus, lobi ad 5.5 mm. longi et 3 mm. lati, ovato-lanceolati, externe nervo primario et marginibus dense hirsutis, cetera laxe hirsuti; interne paene glaber, erectus. Corolla atrocaerulea ad purpurea, glabra, cylindrica, tubus 7–10 mm. longus, calycem excedens vel paene duplo longior; lobi ad 4 mm. longi et 3 mm. lati, ovati vel subrotundati, integri, interne subpuberuli, erecti vel subpatentes; appendices faucales triangularilingulatae, 2–3 mm. longae, 1–1.5 mm. latae ad basim, margines ciliati.

Antherae 1.5–2 mm. longae, oblongae, subsessiles vel filamenta ad 0.5 mm. longa, 3–6 mm. supra basim corollae inserta. Stylus 10 mm. longus, stigma capitatum. Fructus non visus.

DISTRIBUTION: West Pakistan, Kashmir.

West Pakistan: GILGIT AGENCY: Naltar, Sept. 1960, *McVean s.n.* (E).

Kashmir: Pir Panjal, 3600 m., *Drummond 13919* (E-type).

Only three species of the genus *Pseudomertensia* have faucal appendages, which are longer than broad, viz. *P. lindelofioides* (Rech. f. & Riedl) Riedl (in Rechinger, Fl. Iranica 48: 61. 1967), *P. chitralensis* and *P. drummondii*. *P. lindelofioides*, which is distributed in eastern and northeastern Afghanistan and which can be expected in West Pakistan, is distinguished from the other two by having large calyces, 7–8 mm. long, corollas 14–15 mm. long, faucal appendages 3–4 mm. long and filaments 2–3 mm. long. In the other two species, along with the differences in form, the calyces do not exceed 6 mm., the corollas 12 mm., the faucal appendages 3 mm., and the filaments 2 mm. in length.

The new species *Pseudomertensia drummondii* is more closely related to *P. chitralensis* than *P. lindelofioides*. It is distinguished from *P. chitralensis* by having denser and longer, up to 1 mm. long, spreading trichomes on the stems and leaves. The trichomes in *P. chitralensis* are appressed and do not exceed 0.3 mm. in length, except for a few scattered ones on the stem and petioles. The leaves in *P. chitralensis* have much longer petioles, and ovate laminae which are roundish or obtuse at the apices, whereas the leaves of *P. drummondii* have shorter petioles and lanceolate laminae, which are obtuse or acutish at the apices. In texture, the leaves of *P. chitralensis* are thin, while those of *P. drummondii* are thick. Flowers of *P. drummondii* are subsessile or short pedicellate and the pedicels attain a maximum length of 1.5 mm., while the pedicels of *P. chitralensis* ordinarily reach a length of 4 mm. The calyx lobes of the former are ovate to ovate-lanceolate, while those of the latter are linear. Faucal appendages of *P. drummondii* are 2–3 mm. long, 1–1.5 mm. broad at base, triangular and ciliate at the margins, while those of *P. chitralensis* are 0.8–1.2 mm. long, 0.5 mm. broad at base, oblong-lingulate, narrowed in the middle and entire at the margins. The former has longer anthers and shorter filaments compared to those of *P. chitralensis*.

The specimen collected by McVean from Gilgit is a variation of *P. drummondii*. It agrees with the type specimen in all respects, except that it has slightly narrower calyx lobes, smaller corolla and the filaments are inserted only 3 mm. above the corolla base.

7. *P. chitralensis* (Riedl) Riedl in Rechinger, Fl. Iranica 48: 62. 1967.

Mertensia chitralensis Riedl, in Køie & Rechinger, Biol. Skr. 13(4): 228. 1963.

TYPE: Chitral: Runbur, 3200 m., *Bowes Lyon 664* (BM-holotype).

ICON.: Riedl, l. c., fig. 174. 1963, under *Mertensia chitralensis*.

Perennial with underground rhizomes. Emerging shoots simple or branched, \pm 15 cm. tall, tender, clothed with thin, short, appressed trichomes. Basal leaves petiolate; petioles 1–8 cm. long, winged, membranous, ciliate below, clasping the shoots at the bases; lamina shorter than the petioles, elliptic, oblong-ovate or ovate-lanceolate, gradually attenuated towards the base, apex obtuse or roundish, rarely acute, margins entire, 2–5 cm. long, 0.8–1.7 cm. broad, uniformly covered on both surfaces with more or less loose, short, appressed trichomes; upper leaves few, smaller, and with shorter petioles. Inflorescence solitary, short, 2–3 cm. long when young, later elongated, 7–8 cm. long, bearing 7–12 flowers; pedicels 1–4 mm. long. Calyx divided to the base, lobes 4–4.5 mm. long, up to 0.7 mm. broad, in fruit elongated to 6 mm., linear, obtuse, erect, margins densely pubescent, trichomes up to 1 mm. long, few scattered trichomes on the upper surface. Corolla blue to bluish purple, infundibuliform, glabrous, 10–12 mm. long, tube 7–9 mm. long, slightly dilated upwards, lobes roundish, obliquely patent, ca. 2 mm. long and broad; faucal appendages 0.8–1.2 mm. long, 0.5 mm. broad, narrowed in the middle, slightly emarginate above. Anthers oblong, more or less rounded at both ends, ca. 1.2 mm. long, 0.4 mm. broad, tips approaching the sinuses between the corolla lobes; filaments 0.7 mm. long, slightly dilated at base, attached below the faucal appendages. Style filiform, ca. 11 mm. long; stigma capitate. Nutlets oblong or ovate, trigonous, 2.5–3 mm. long, ca. 1 mm. broad, slightly puberulous externally, pubescent inside, pallid.

DISTRIBUTION: West Pakistan.

West Pakistan: CHITRAL STATE: Rumbur, 3200 m., *Bowes Lyon 664* (BM); Pattisun, *Toppin 191* (K).

8. *P. anjumiae* Kazmi, sp. nov.¹

TYPE: West Pakistan: Kurram, up the Shend Toi valley, near water at an elevation of 11,000 ft., *Aitchison 192* (BM-holotype, GH-isotype).

Surculi tenues subterranei, radices fibrosas emittentes fibroso-radicantes et squamis parvis obsiti. Caules floriferi ad 20 cm. longi, arcuati vel erecti tenues herbacei, pilis patulis sparse obsiti, in cincinnum singulum terminalem aphyllum abeuntes. Folia basalia plura, lamina oblongo-ovata vel oblanceolata, (1–)2–4(–5) cm. longa, 5–10 mm. lata, basi longe attenuata, apice breviter attenuata vel subrotundata, plana, integra, tenuissime molliterque herbacea, costa mediana tenuis, nervis secundariis vix visibilibus, supra et subtus pilis sparsis brevissimis appressis tecta, longe tenuiter petiolata, petiolo 2–5 cm. longo; folia caulina pauca breviter petiolata, petiolis 4 cm. longis, 0.5 mm. latis. Inflorescentiae solitariae, primo densae, scorpioideae demum ad 8 cm. elongatae, 5–20-florae. Pedicelli 1–10 mm. longi. Calyx 3–4 mm. longus ad basin usque in laciniis anguste linearibus obtusis fissus, pilis arcuatis patulis ad 1 mm. longis obsitus. Corolla quam calyx duplo longior, in sicco caeruleo-violacea, 8

¹ I named this species after the name of my wife, Anjum.

mm. longa, subcylindrica vel infundibuliformis, utrinque glabra, lobis erectis vel oblique patulis, ca. 1.5 mm. longis et latis, rotundatis. Fornices tenuiter evoluti. Filamenta 1–1.2 mm. longa, 7 mm. supra basin tubi affixa. Antherae ca. 1 mm. longae versatiles, atrae, oblongae, ad apicem et basin rotundatae. Stylus corollam saepe superans, tenuiter filiformis, pallidus. Stigma minutum subcapitatum. Nuculae ignotae.

DISTRIBUTION: West Pakistan.

West Pakistan: KURRAM: Shend Toi valley, *Aitchison* 192 (BM, GH).

The specimen cited here, collected by Aitchison from Kurram valley, has been cited by Riedl (in Rechinger, *Fl. Iranica* 48: 62. 1967) under *Pseudomertensia echiodes*. On close examination it was found to be very different from that species and to be worthy of recognition. The important distinguishing characters of *P. echiodes* are the very short (0.5 mm.) filaments, shorter than the anthers (1.5–1.9 mm.) which are acute at their apices, and the absence of faucal appendages. These characters are well correlated with the long (3–4.5 mm.) and narrow (1.5 mm.) corolla lobes, which more or less equal or sometimes even exceed the corolla tube in length. *Pseudomertensia anjumiae* differs from *P. echiodes* in having longer (1–1.2 mm.) filaments, equalling or slightly exceeding the length (1 mm.) of the anthers which are roundish at apices. The faucal appendages are quite developed. Corolla lobes are much reduced, only 1.5 mm. long and broad, about 1/5 the length of the corolla tube, and not oblong-ovate but roundish. *Pseudomertensia anjumiae* is distinguished from the related species, *P. moltkioides*, in having shorter corolla lobes and longer filaments. In *P. moltkioides* corolla lobes are 2.5–4.5 mm. long, 2–3 mm. broad, and oblong-ovate in shape; the filaments, 0–0.5 mm. long, are dilated at the base.

9. *P. nemorosa* (DC.) Stewart & Kazmi, comb. nov.

Lithospermum ovalifolium Decne. in Jacquem. Voy. Inde Bot. 121. 1844.

Eritrichium nemorosum A. DC. in DC. Prodr. 10: 123. 1846.

Mertensia nemorosa (DC.) I. M. Johnston, Jour. Arnold Arb. 37: 305. 1956.

Mertensia moltkioides (Benth.) C. B. Clarke var. *thomsoni* C. B. Clarke in Hook. f. Fl. Brit. India 4: 170. 1883, *syn. nov.*

TYPE: Kashmir: In humidis nemorum ad Ouri, May 4, 1831, *Jacquemont s.n.* (GH, P).

ICON.: Jacquemont, l. c. t. 124. 1844, under *Lithospermum ovalifolium*; Coventry, Wild Fl. Kashmir 3: t. 44. 1930, under *Mertensia moltkioides*.

Perennial with stout, little branched, underground rhizomes, up to 20 cm. long, sometimes to 10 mm. thick. Emerging shoots weak, curved or erect, 6–15(–20) cm. tall, clothed mostly with spreading, thin, white trichomes up to 1 mm. long. Basal leaves petiolate; petioles 2–8 cm. long, hairy, broad and clasping the shoot at their bases; lamina ovate, elliptic, or ovate-lanceolate, margins entire, mostly acute at apex, round or ob-

tuse at base, rarely truncate, never cordate, (2-)3-7(-8) cm. long, 1-4.5 cm. broad, upper surface slightly hairy, lower surface comparatively densely hairy especially on nerves, trichomes thin, not arising from tuberculate bases, appressed to suberect, rarely patent; upper cauline leaves shorter, narrower, with short petioles, subsessile or sessile. Inflorescence at flowering 4-9 cm. long, bearing 6-14 flowers, in fruit much elongated, with fruits sometimes up to 10 mm. distant; pedicels 1-9 mm. long, hairy. Calyx divided to the base, lobes linear-oblong, obtusish, erect, up to 7 mm. long, covered externally with subappressed or spreading trichomes. Corolla blue, bluish-purple to deep blue, glabrous, corolla tube cylindrical, (8-)9-11 mm. long, lobes ovate, suberect to patent, 3.5-4 mm. long, 3-3.5 mm. broad at the base; faucal appendages small 0.7-0.8 mm. broad, 0.5-0.6 mm. long, anthers 1 mm. long, 0.5 mm. broad, oblong, rounded at both ends. Filaments very short, nearly triangular, 0.5 mm. high, 0.7 mm. broad at the dilated base, attached in between and slightly below the bases of the faucal appendages. Style filiform, ca. 8 mm. long; stigma small, subcapitate. Nutlets 3 mm. long, 1.5 mm. broad, acute at apices, slightly verruculose on the ridges, dark brown.

DISTRIBUTION: West Pakistan, Kashmir, northwest India.

West Pakistan: HAZARA DIST.: Kaghan valley, between Naran and Batakundi, *Kazmi 795a* (PES); SWAT STATE: Mt. Ilam, *R. R. Stewart 24373* (RAW); Miscellaneous: locality unknown (probably from Swat) *Kazmi s.n.* (PES).

Kashmir: Poonch: Serimang, 2000-2700 m., *R. R. Stewart & Nasir 25540* (BM); Lidder valley: Kolhoi, *Inayat 25711* (K); 3300 m., *Ludlow 8* (BM); Chashma Shai, 2300 m., *R. R. Stewart 10926* (GH); above Uri on Poonch road, 2000 m., *R. R. Stewart 12954* (GH); ad Ouri (Uri ca. 20 miles from Baramula and 40 miles west of Srinagar), *Jacquemont s.n.* (GH, P); Lidderwat, 3000 m., *Coventry 575* (K), *Evershad s.n.* (BM); Sind valley, Gangangir, 2500 m., *Rich 1075* (K); Kishanganga valley: near Nilam, *Kazmi s.n.* (PES); Islampur, *Kazmi 295b* (PES); Kel, *Kazmi s.n.* (PES); between Shardi and Kel, 1950-2100 m., *Schmid 1744* (BM, MICH); Sind valley, Mehanmarg, 2500 m., *Ludlow & Sherriif 8147* (BM); Chenab-Ravi watershed, Badawar to Padri Pass, June 3, 1848, *Thomson s.n.* (K); south of Chenab valley between Baleta and Katti, Herb. Ind. Or. Hook. f. & Thoms., May 14, 1948, *Thomson s.n.* (K). Miscellaneous: Hab. Himal. Occ., 6000-7000 ped., Herb. Ind. Or. Hook. f. & Thoms., *Thomson s.n.* (GH); Herb. East India Co., *Falconer s.n.* (GH); *Palmer s.n.* (BM).

Pseudomertensia nemorosa is very closely related to *Mertensia racemosa* (Royle) C. B. Clarke (in Hook. f. Fl. Brit. India 4: 171. 1883) of Kumaon, Bashahar and Kulu, which also agrees more closely in its characters to *Pseudomertensia* than to *Mertensia* and is here recombined as *Pseudomertensia racemosa* (Royle) Kazmi.² *Pseudomertensia nemorosa* differs from *P. racemosa* in its blue-purple rather than white corollas, its more pubescent leaves, not subcordate at the bases, and its coarser

² *Pseudomertensia racemosa* (Royle) Kazmi, comb. nov.

Myosotis racemosa Benth. in Royle, Illustr. Bot. Himal. Mount. 1: 305. 1839.

Mertensia racemosa (Royle) C. B. Clarke in Hook. f. Fl. Brit. India 4: 171. 1883.

habit. The next most closely related species is *P. moltkoides* from which it differs mainly in the form and size of leaves. In *P. moltkoides* the leaves are oblong, oblong-lanceolate, lanceolate, or rarely narrowly lanceolate and are up to 10(–12) mm. broad, their bases always attenuated into short or long petioles; while in *P. nemorosa* the leaves are ovate, elliptic, or ovate-lanceolate, and are usually 10–45 mm. broad, their bases always round, obtuse or rarely truncate, and not gradually attenuated into petioles as in *P. moltkoides*.

Dr. R. R. Stewart has compared the specimens, *Inayat* 25711 and *Rich* 1075 at the Kew Herbarium with Thomson's collection from Islamabad, Kashmir, on which *Mertensia moltkoides* var. *thomsoni* C. B. Clarke (in Hook. f. Fl. Brit. India 4: 170. 1883) is based, and found them to be identical. These specimens (cited above) and Clarke's description "Radical leaves $3 \times 1\frac{1}{2}$ in. (75 mm. long, 40 mm. broad), base sub-obtuse" agree with *P. nemorosa*.

10. *P. moltkoides* (Royle ex Benth.) Kazmi, comb. nov.

Myosotis moltkoides Royle ex Benth. in Royle, Illustr. Bot. Himal. Mount. 1: 305. 1836; t. 73. fig. 1. [Dec.] 1835.

Anchusa moltkoides Royle ex Benth. l. c.; DC. Prodr. 10: 51. 1846.

Lithospermum moltkoides (Royle ex Benth.) Decne. in Jacquem. Voy. Inde Bot. 122. 1844.

Mertensia tibetica C. B. Clarke in Hook. f. Fl. Brit. India 4: 171. 1883.

Mertensia nuristanica Rech. f. Ann. Naturh. Mus. Wien 58: 56. 1951.

TYPE: Kashmir: Pirpenjal, *Royle* (?)

ICON.: Royle, l. c. 1835, under *Anchusa moltkoides*.

Perennial with long, slender, branched, underground rhizomes, up to 5 mm. thick. Emerging shoots profusely leafy at the bases, naked or with few distant leaves above, 5–15 cm. tall, clothed usually with short and appressed or sometimes with long and patent trichomes. Basal leaves petiolate, petioles shorter or longer than lamina, lamina oblong to oblong-lanceolate to lanceolate, rarely linear-lanceolate, entire, acute to obtuse, (including petioles) 15–70(–80) mm. long, 2–10(–12) mm. broad, covered on both surfaces with short appressed to subappressed trichomes, rarely glabrous below, cauline leaves few, sessile, shorter and narrower than the basal ones. Inflorescence 2–3 cm. long with sessile or subsessile closely set flowers when young, later elongated up to 7 cm. long, with distant (up to 10 mm. apart), short pedicellate flowers; pedicels up to 3 mm. long. Calyx divided to the base, lobes linear to linear-lanceolate, obtuse to acute, erect, 3–4(–5) mm. long, 0.5 mm. broad, covered with short, patent to subpatent trichomes. Corolla blue, bluish-purple to deep bluish-purple, infundibuliform, externally glabrous, internally glabrous to puberulous or minutely pubescent above the throat, tube 8–15 mm. long, lobes oblong-ovate, patent, 2.5–4.5 mm. long, 2–3 mm. broad; faucal appendages well developed, broader than long, slightly emarginate and puberulous. Anthers oblong, roundish at both ends, 1–1.75 mm. long;

filaments more or less broad at the base, 0–0.5 mm. long. Style filiform; stigma subcapitate. Nutlets ovate, trigonous, light to dark brown, 3 mm. long.

DISTRIBUTION OF SPECIES: Afghanistan, West Pakistan, Kashmir, northwest India, and Tibet.

This species, *Pseudomertensia moltkoides*, is very variable in the length of petioles and lamina, number of leaves on the shoots, length of calyx lobes and corolla tube, indument of minute trichomes on the corolla throat, and the insertion of the anthers on the corolla. The four varieties which follow may easily be distinguished from one another.

KEY TO THE VARIETIES

- a. Anthers distinctly below the bases of the faucal appendages. 10a. var. *moltkoides*.
- a. Anthers distinctly exceeding or surpassing the bases of the faucal appendages.
 - b. Leaves linear-spathulate. 10d. var. *tanneri*.
 - b. Leaves oblong to oblong-lanceolate.
 - c. Leaves short petiolate, scapes naked, corolla internally, above the throat, puberulous. 10b. var. *primuloides*.
 - c. Leaves with long petioles, scapes leafy, corolla internally, above the throat, densely minutely pubescent. 10c. var. *leichtlinii*.

10a. Var. *moltkoides*.

Basal leaves usually with long, rarely with short petioles; corolla tube mostly 3–5 times longer than the calyx; corolla usually glabrous within, rarely puberulous; anther tips just below to a few millimeters below the faucal appendages.

West Pakistan: CHITRAL STATE: Golen, Shishikuh, 4700 m., *Bowes Lyon* 106 (BM). GILGIT AGENCY: Rama valley, southwest of Astore, 4000 m., *Lankester & Pearson* 1402, 1342 (BM); upper end of Hushe valley, Chogolisa glacier basin, *Webster* 6241 (GH), *Humphrey & Sufi* s.n. (MICH); at the foot of Masherbrum, *Webster & Nasir* 6202 (GH); Astor, Alampila, *Duthie* 1217 (BM, K); Kamri top, 4000 m., *R. R. Stewart* 18675 (GH); Mekerum, Hispar glacier, 3500 m., *Russell* 1450 (GH); Haramosh La, *Culbert* 86 (BM); Agres Camp, below Hispar Pass, Karakorum, 4100 m., *Conway* 209 (BM); near Hispar, Shukurri, 4400 m., *Conway* 166 (K); Nagar, Gharesa glacier, slope facing north, 12 miles east of Nagar, *Polunin* 6127 (BM); Minapin glacier, 4100 m., *Lloyd & Megan* 105 (BM). HAZARA DIST.: Kaghan valley, between Naran and Saiful Maluk, ca. 2700 m., *Kazmi* 200b (PES); Ganji Pahari, near Naran, half way to the top, ca. 2500 m., *Kazmi* 852c (PES); 1.5 miles north of Naran, *Burt & Arshad Ali* B857 (E); Basal, *Schmid* 363 (E); between Shahid Pani and Musa ka Musalah, on rocky slope facing Kaghan valley, ca. 3000 m., *Kazmi* 2514 (PES); Siran valley, near the foot of Musa ka Musalah, ca. 2800 m., *Kazmi* 2491 (PES).

Kashmir: Apharwat above Gulmarg, 4000 m., *Rich* 1230 (K); Apharwat, 4400 m., *Polunin* 56/196 (E); above Gulmarg, *Fuller* 153 (K); Pirpanjal, *Inayat* 25707 (K); top of Masjid Gali, 4500 m., *R. R. Stewart* 18363 (GH,

MICH); Kishtwar, Dudhari Pass, 4000 m., *Ludlow & Sherrieff* 9216 (GH); Kishanganga valley, above Nilam, ca. 3200 m., *Kazmi* 302c (PES); Chinari, Zakia Bandi, on rocky slopes, *Kazmi* 258a (PES).

The binomial *Mertensia moltkoides* (Benth. in Royle) C. B. Clarke (in Hook. f. Fl. Brit. India 4: 170. 1883) is based on the illustration of *Anchusa moltkoides* (Royle ex Benth. in Royle, l. c. t. 73. fig. 1. 1835), described by Royle ex Bentham (in Royle, l. c. 1: 305. 1836) as *Myosotis moltkoides*, is a misidentification which was further confused by C. B. Clarke's description (l. c.) and, therefore, ignored by many authors.

The illustration of *Anchusa moltkoides* gives all the necessary details of the form of the leaves and the structure of flowers and should be accepted as type.

This illustration shows clearly the scapose peduncle, oblong leaves with long petioles, and the anthers distinctly below the faucal appendages. On the basis of these distinguishing characters two of the three specimens cited by C. B. Clarke (l. c.) (Kashmir, *Falconer*, and near Islamabad, *Thomson*) do not agree with *M. moltkoides*, but are, rather, *Pseudomertensia nemorosa*. The collection of Dr. Watt from Pangee, which I was unable to examine, may also not belong to *Mertensia moltkoides*.

Actually C. B. Clarke's description of *Mertensia tibetica* represents the type of *Pseudomertensia moltkoides*. He cited the following details "—leaves small subradical long-petioled elliptic, peduncles long subscapose — anthers entirely below the scales — nutlets as of *M. moltkoides*." *Pseudomertensia nuristanica* Rech. f. represents only a form of *P. moltkoides* in which the anthers are attached to the corolla tube a few millimeters below the faucal appendages. Both these binomials are therefore synonyms of *P. moltkoides*.

Riedl (in Rechinger, Fl. Iranica l. c.) recognized the specific name *Pseudomertensia primuloides* for the taxon containing the forms of *Mertensia tibetica* and *M. nuristanica*. As the dates of publication of Royle's Illustr. (l. c. 1835, 1836) precede the date of publication of Jacquemont's Voyage (l. c. 1844), *P. moltkoides* has priority.

10b. Var. *primuloides* (Decne.) Kazmi, comb. nov.

Eritrichium primuloides Decne. in Jacquem. Voy. Inde Bot. 123. 1844; DC. Prodr. 10: 125. 1846.

Mertensia primuloides (Decne.) C. B. Clarke in Hook. f. Fl. Brit. India 4: 171. 1883, excl. var.

Pseudomertensia primuloides (Decne.) Riedl in Rechinger, Fl. Iranica 48: 62. 1967, *pro parte*.

TYPE: Kashmir: Pirpenjal, *Jacquemont* s.n. (P).

ICON.: Jacquemont, l. c. t. 128. 1843.

Basal leaves usually with short, sometimes with long petioles; corolla tube usually 2 to 3 times longer than the calyx; corolla internally, above the throat, usually puberulous, sometimes minutely pubescent; anthers distinctly exceeding or surpassing the bases of faucal appendages.

West Pakistan: CHITRAL STATE: Drosh Nullah, 3800 m., *Toppin* 757 (K); Shera Shing Pass, 4800 m., *Stainton* 3208 (BM); Ziarat (Lowari Pass), 3000 m., *Stainton* 3208 (BM), 2330 (E). HAZARA DIST.: Kaghan valley, *Champion s.n.* (GH); Makra, 4500 m., *Duthie s.n.* (K); between Shogran and Bhunja, *Kazmi* 732b (PES); near Sari, between Shogran and Makra, ca. 3000 m., *Kazmi* 2212b (PES); Chapri, 28. 7. 1899, *Inayat s.n.* (K); Naran, stony ground, 3000 m., *Jafri & Ali* 3389, 3332 (E); Naran, June 1960, *McVean s.n.* (E). Miscellaneous: northwest India (marked b), *J. L. Stewart s.n.* (E).

Kashmir: Apharwat, above Gulmarg, 3400 m., *Pinfeld* 193 (BM), *Rich* 1257 (K), *R. R. Stewart* 15486, 10327, 8604 (GH), *Steane* 43 (E); above Gulmarg, *Aitchison* 73 (K); Pirpanjal, 10. 8. 1901, *Inayat s.n.* (K); Bringhi valley, Mantnar Nullah, 4300 m., *Ludlow & Sherrieff* 8050 (BM, GH); Mantnar valley, near Desu, 4100 m., *Ludlow* 115 (GH); Kishenganga valley, near Nilam, *Kazmi* 316b (PES); Muzafarabad, Musa, 18. 7. 1899, *Inayat s.n.* (K); Kamri Pass, 4500 m., *Duthie* 12576 (BM); Kamri Pass top, 4300–4600 m., *R. R. Stewart* 22690 (GH); Ablau valley, Bringhi river, 4000–4300 m., *Ludlow* 21 (BM).

Among the specimens cited above, *Ludlow* 21 differs from the others in having filaments up to 0.5 mm. long.

10c. Var. *leichtlinii* Kazmi, var. nov.

TYPE: Hazara, *Max Leichtlin* 4 (BM).

Folia basalia longipetiolata, petiolis saepe laminis aequantibus; corolla intra, supra appendices fauces, minute densique pubescens; scapi plerumque foliati.

West Pakistan: HAZARA DIST.: *Duthie s.n.* (K); *Leichtlin* 4 (BM-holotype of var.); between Balaket and Babusar Pass, *Abel* 132 (BM); Kaghan valley, Naran, *Shaukat Ali* 125 (BM).

10d. Var. *tanneri* (C. B. Clarke) Stewart & Kazmi, comb. nov.

Mertensia primuloides (Decne.) C. B. Clarke var. *tanneri* C. B. Clarke in Hook. f. Fl. Brit. India 4: 171. 1883.

TYPE: Daskin, Astore, *Tanner* 10 (K).

ICON.: Riedl, in Kjøie & Rechinger, Biol. Skr. 13(4): fig. 125. 1963.

Leaves linear-spathulate with longer petioles, calyx lobes 4–5 mm. long; corolla violet, corolla tube ca. 8 mm. long.

West Pakistan: GILGIT AGENCY: Daskin, Astore, *Tanner* 10 (K); Sai, Gilgit, *Tanner s.n.* (K); Rattu et Goriket, *Schmid* 1774 (BM); Rama valley, southwest of Astore, 3500 m., *Lankester & Pearson* 2030 (BM). HAZARA DIST.: Kaghan valley, Naran, *Barrett s.n.* (K).

9. *Anoplocaryum* Ledeb. Fl. Rossica 3: 154. 1847.

Echinospermum sect. 3. *Anoplocaryum* Turcz. in Bull. Soc. Nat. Moscou 23(1): 522. 1850.

TYPE SPECIES: *Anoplocaryum compressum* (Turcz.) Ledeb.

Annual (or perennial ?) herbs. Basal leaves usually petiolate. Inflorescence bracteate, pedicellate, pedicels usually longer than the calyx and reflexed in fruit. Calyx divided to the base, not much enlarged in fruit. Corolla hypocrateriform to subrotate; faucal appendages distinct. Gynobase shortly pyramidal with 4 triangular depressions. Nutlets ovoid, rough or slightly tuberculate, margins irregularly setulose, carinate internally from the carunculate scar to the top.

Species about 5, distributed from China to the Western Himalayas.

A. brandisii Brand, Repert. Sp. Nov. 22: 100. 1925, Pflanzenr. IV. 252(Heft 97): 116. 1931.

TYPE: Chamba State: Sach Pangi, *Brandis 3166* (DD); Lahul, *Brandis 3236* (DD); Haelle (?), *Brandis 3996* (DD), holotype not indicated.

Perennial or annual herb. Stems many, slender, thinly covered with short, thin, appressed trichomes, 15–30 cm. tall. Basal leaves 15–25 mm. long, 2–4 mm. broad, entire, obtuse, gradually narrowed at the base into a short petiole, covered with thin, short, appressed trichomes on both surfaces; cauline leaves subsessile to sessile, shorter and narrower. Inflorescence terminal, lax, lower flowers bracteate; pedicels hairy, 1–2 mm. long, elongated in fruit, to 12 mm., recurved. Calyx divided to the base, lobes lanceolate, slightly hairy, in flower 1.5 mm. long, in fruit usually subreflexed, to 2.5 mm. long, 0.5 mm. broad. Corolla subrotate, 4–5 mm. in diameter; faucal appendages semilunar. Gynobase triangular, distinct from the equally long style. Nutlets 3–4, ovoid, 2 mm. long, margins densely minutely setulose, granulate and slightly rugose on both surfaces, internally distinctly and externally slightly carinate, attached obliquely to the gynobase by a large carunculate scar.

DISTRIBUTION: West Pakistan, Kashmir, northwest India.

West Pakistan: GILGIT AGENCY: Niltar valley, north of Gilgit, 3500–3700 m., *Duthie 12425* (GH, K). Reported from near Gilgit, *Roberts* (Brand, *l. c.*).

10. *Eritrichium* Schrad. Comment. 4: 186. 1820.

Eritrichium Schrad. sect. *Eu-eritrichium* DC. Prodr. 10: 124. 1846.

TYPE SPECIES: *E. nanum* (Vill.) Schrad.

Annual or perennial, strigose or villous herbs with alternate leaves. Racemes simple or branched, usually terminal or sometimes axillary. Calyx divided to the base, lobes 5, sometimes enlarged and reflexed in fruit. Corolla subrotate to infundibuliform, lobes spreading; faucal appendages distinct. Stamens inserted on the corolla tube, included; anthers ovate. Ovary 4-lobed, style filiform, stigma capitate. Gynobase subprismatic-pyramidal, shorter than the style. Nutlets 4, surpassing the gynobase, attached obliquely to the depressions in the gynobase, at margins usually appendiculate; appendages various.

Species about 25, centering in Asia, distributed to Europe and America.

KEY TO THE SPECIES

- a. Basal leaves in rosettes, sessile, covered on both surfaces with trichomes 1–2 mm. long, margins ciliate. 1. *E. nanum*.
- a. Basal leaves not in rosettes, petiolate, covered on both surfaces with trichomes up to 1 mm. long, margins usually not ciliate, rarely with a few scattered long trichomes.
 - b. Cauline leaves gradually narrowed towards the bases, subsessile to short petiolate. 2. *E. fruticosum*.
 - b. Cauline leaves broad at the bases, always sessile.
 - c. Cauline leaves ovate to oblong-ovate, roundish to obtuse at apices, usually covered with unequal trichomes. 3. *E. spathulatum*.
 - c. Cauline leaves oblong-lanceolate to linear-filiform, apices obtuse to acute, usually covered with equal trichomes.
 - d. Nutlets triangular-oblong (excluding appendages), 1.5 mm. long, 1 mm. broad, outer surface convex or slightly longitudinally raised in the middle, marginal appendages 0.2 mm. long, distant, not confluent at their bases. 4. *E. patens*.
 - d. Nutlets ovate (excluding appendages), 2 mm. long, 1.5 mm. broad, outer surface plane or slightly concave, marginal appendages 1 mm. long, confluent at their bases. 5. *E. canum*.

1. *E. nanum* (Vill.) Schrad. Comment. Soc. Regiae Sci. Gott. 4: 186. 1820; M. Pop. in Fl. URSS. 19: 514. 1953; Riedl in Rechinger, Fl. Iranica 48: 64. 1967.

Myosotis nana Vill. Hist. Pl. Dauph. 2: 459. 1878, Prosp. Pl. Dauph. 21. 1879.

TYPE: "Sur les sommets des Alpes au dessus de Brande et d'Allemont . . .," without citation of collector's name (?).

ICON.: Vill. l. c. t. 13. 1878; Hegi, Ill. Fl. Mitt.-Eur. 5(3): t. 219, fig. 2a–c, & fig. 3095. 1927.

Perennial, densely caespitose; roots much branched near the surface of the ground, each branch bearing a thick rosette of leaves and producing a single, usually simple or rarely branched stem. Stems very short, to 12 cm. long, covered thinly or densely with thin, silky, usually spreading trichomes. Basal leaves numerous, sessile, oblong-lanceolate, entire, roundish or obtuse at apices, margins thickly ciliate, 5–10 mm. long, 2–3(–5) mm. broad, both surfaces covered with thin, silky, trichomes up to 2 mm. long; cauline leaves few, usually narrower. Inflorescence short, 3–6-flowered, lower flowers bracteate, bracts leaflike, 1–2 mm. long; upper flowers subsessile, lower flowers pedicellate, pedicels up to 1.5 mm. long, hairy. Calyx divided nearly to the base, lobes oblong-lanceolate, in flower 2.5–3 mm. long, in fruit elongated to 4 mm., densely hairy, trichomes long, sometimes yellowish. Corolla usually blue, rarely white, with a yellow eye, campanulate-rotate, tube equalling or a little longer than the calyx, slightly narrowed at the throat, lobes ovate, spreading,

0.5–3.5 mm. long, 1–3 mm. broad; faucal appendages linear-horizontal. Nutlets ca. 2.5 mm. long, at margins dentate, glabrous.

DISTRIBUTION OF SPECIES: European Alps, Caucasus, Altai, Siberia, western China, Tibet, Afghanistan, West Pakistan, Kashmir, northwestern India.

1a. Subsp. *nanum*.

Basal leaves many; stems short; corolla 6–7 mm. long.

DISTRIBUTION OF SUBSP.: Represents the species in the European and western Asian portions of its range.

1b. Subsp. *villosum* (Ledeb.) Brand, Pflanzenr. IV. 252 (Heft 97): 189. 1931; Riedl in Rechinger, Fl. Iranica 48: 64. 1967.

Myosotis villosa Ledeb. Mem. Acad. St.-Pétersb. 5: 516. 1815; Flora Altaica 1: 191. 1829.

Eritrichium villosum (Ledeb.) Bunge, Verzeichn. Altaigebirg. Pflanzen 14. 1836; DC. Prodr. 10: 126. 1846.

Echinospermum sericeum Benth. in Royle, Illustr. Bot. Himal. Mount. 306. 1836.

Eritrichium sericeum (Benth. in Royle) DC. Prodr. 10: 126. 1846.

Eritrichium basifixum C. B. Clarke in Hook. f. Fl. Brit. India 4: 165. 1883.

E. nanum subsp. *villosum* var. *eu-villosum* Brand, l. c. 190. 1931.

TYPE: "Habitat in Sibiriae alpibus," without citation of collector's name (LE).

ICON.: Ledeb. Icon. Fl. Rossica 2: t. 215. 1830.

Basal leaves few, stems longer than in the typical subsp.; corolla 3–5.5 mm. long.

DISTRIBUTION OF SUBSP.: Altai, Siberia, Tibet, Afghanistan, West Pakistan, Kashmir, and northwest India.

West Pakistan: GILGIT AGENCY: Rimochagma valley 4700 m., 20. 7. 1892, Duthie s.n. (BM, E); Baltistan, Hunter-Weston 10253 (MICH); snow field on the south slope of Burja La, 4700–5000 m., Webster & Nazir 6546 (GH); Talala, 4300 m., Koelz 9747 (GH), R. R. Stewart 20770 (GH); Jutial Nullah, R. R. Stewart 26326 (BM); Ramna valley, southwest of Astore, 4000 m., Lankester & Pearson 1345, 1346 (BM); Chota Deosai, 4000–4500 m., R. R. Stewart 19934 (GH, MICH, US). HAZARA DIST.: Kaghan valley, between Paya and Makra, above Shogran, ca. 3000 m., Kazmi 2144b (PES); Gitidas, 3700 m., Metz s.n. (MICH); Kaghan valley, I. I. Chaudhri s.n. (RAW); Siran valley, near Shahid Pani, ca. 3100 m., Kazmi 193c (PES).

Kashmir: Kamri Pass top, 4500 m., R. R. & I. D. Stewart 18708, 22677 (GH); Burzil Pass, 4300 m., Duthie 14038 (BM); Zaskar, Pansi La, 5500 m., Koelz 5938 (GH, MICH, US); Kargia, Lagong, 4500 m., Koelz 5392 (GH, MICH, US); Ladak, Hanu Yogma via Handamir up the Cherbat La Pass (Pass between Indus valley and the Shayok valley), Schlagintweit 6513 (GH); Barnaj Nullah, Sap-

phire mines, Kishtwar, *Ludlow & Sherriff 9151* (GH); Masjid Gali top, 4000 m., *R. R. & I. D. Stewart 18363B* (GH).

2. *E. fruticulosum* Klotzsch, Reis. Prinz Wald. Bot. 96. 1862.

E. strictum Decne. in Jacquem. var. *fruticulosum* (Klotzsch) C. B. Clarke in Hook. f. Fl. Brit. India 4: 164. 1883.

TYPE: Himalaya, *Dr. Hoffmeister s.n.* (HEID).

ICON.: Klotzsch, l. c. t. 62. 1862.

Perennial herb with woody tap root up to 15 cm. long. Stems many, erect to decumbent, slender, up to 30 cm. long, simple or sometimes branched in the upper part; branches short, stem and branches green, covered with thin, white, antrorsely appressed or subappressed soft trichomes not exceeding 0.5 mm. in length. Basal leaves few, petiolate, petioles slender, hairy, up to 20 mm. long; lamina pale green, ovate-lanceolate, ca. 25 mm. long, 5 mm. broad, obtuse, attenuate towards the base, covered uniformly and loosely on both surfaces with thin, appressed trichomes up to 0.5 mm. long; cauline leaves subsessile to short petiolate, petioles sometimes up to 3 mm. long, lamina as in the basal leaves, acutish, shorter and narrower. Inflorescence simple or rarely geminate, racemes loose, 10–15-flowered, bracteate; pedicels slender, hairy, more or less reflexed in fruit, up to 6 mm. long. Calyx divided to the base, lobes 1–1.5 mm. long, 0.2–0.3 mm. broad in flower, lanceolate, narrower towards the base, pubescent on both faces, enlarged in fruit to 2.5 mm. long and 0.7 mm. broad, spreading or slightly reflexed. Corolla light blue with a yellow eye, rotate, tube more or less equalling the calyx, lobes roundish, 1.5 mm. long and broad. Nutlets 4, excluding glochidiate appendages, 1.7–2 mm. long, 0.8–1 mm. broad, roundish at the base, acutish at apex, outer face convex, margined with glochidiate non-confluent appendages, 0.5 mm. long, 0.2 mm. broad at base, pubescent on both faces with short, stiff, erect trichomes.

DISTRIBUTION: West Pakistan, Kashmir, northwest India.

West Pakistan: GILGIT AGENCY: Gilgit proper, Manugah Nala, river bank, 3500 m., *J. W. Thornley 27* (BM); Baltistan, Shagurthang valley, 3000–3500 m., *Duthie 12144* (BM); Hunza, near Baltit, 3000 m., *R. R. Stewart 26327* (BM). QUETTA DIST.: Ziarat, 2600 m., 10. 9. 1887, *Lace s.n.* (E).

Kashmir: Ladakh, Gya, *Koelz 6412* (MICH, US); Nubra, Tsanglung Pass to Murzetau, 31. 7. 1856, *Schlagintweit s.n.* (GH); Rupshu, 4700 m., *Koelz 6654* (MICH, US). Miscellaneous: Himal. Bor. Occ., Herb. Ind. Or. Hook. f. & Thoms., *Thomson s.n.* (BM, GH).

C. B. Clarke (*l. c.*) recognizes *Eritrichium fruticulosum* as a variety of *E. strictum* and distinguishes it from *E. strictum* and its variety *thomsoni* by "weaker, greener, stems diffuse sometimes with divaricate branches." *Eritrichium strictum* and its variety *thomsoni* are considered in this work as synonyms of *E. canum* from which *E. fruticulosum* differs not only in

being more herbaceous with slender and more or less decumbent stems, but also in the form and pubescence of the leaves, and the shape and appendages of the nutlets.

The figure given by Klotzsch (*l. c.*), which should be accepted as the type, shows very clearly the sessile or short petiolate cauline leaves narrowed towards the base, generally thinly and uniformly covered with very short appressed trichomes. These characters together with the oblong form of the nutlets, which are roundish at the base and acutish at apex, margined with non-confluent appendages 0.5 mm. long, 0.2 mm. broad at the base and with both surfaces covered with short, stiff, erect trichomes, distinguish this species from its close relatives. In *E. canum* and its varieties the leaves are densely pubescent and are not gradually attenuated towards the base, but are broad and sessile. The nutlets are larger, with longer appendages, confluent at base and forming narrow or broad marginal wings.

3. *E. spathulatum* (Benth. in Royle) C. B. Clarke in Hook. f. Fl. Brit. India 4: 164. 1883.

Echinospermum spathulatum Benth. in Royle Illustr. Bot. Himal. Mount. 306. 1836; DC. Prodr. 10: 142. 1846.

Eritrichium jacquemontii Decne. in Jacquem. Voy. Inde Bot. 122. t. 127. 1843.

E. rupestre (Pall.) Bunge var. *pectinatum* (Pall.) Brand subvar. *spathulatum* (Benth. in Royle) Brand, Pflanzenr. IV. 252(Heft 97): 193. 1931.

TYPE: Chango in Kunawur, with citation of collector's name (κ, ρ).

ICON.: Jacquemont, *l. c.* t. 127. 1843, as *Eritrichium jacquemontii*.

Perennial, weak, decumbent herb. Stems many, to 20 cm. long, simple or branched, greenish, covered thinly or densely with short, appressed, white trichomes. Basal leaves petiolate, petioles 10–20 mm. long, slender, hairy; lamina, ovate-lanceolate, 20–30 mm. long, 3–7 mm. broad, gradually attenuated towards the petiole, obtuse to roundish at apex, margins entire, both surfaces covered thinly or densely, usually with unequal, subpatent white trichomes sometimes arising from tuberculate bases, up to 0.5 mm. long or even longer at the margins; cauline leaves sessile, oblong-ovate to ovate, gradually becoming reduced in size upwards, indument similar to that of basal leaves. Inflorescence usually branched, up to 20 mm. long, hairy, many flowered, bracteate, bracts ovate; pedicels slender, hairy, in flower up to 2 mm. long, in fruit to 6 mm. long, erect. Calyx divided to the base, lobes oblong-ovate, 1.5 mm. long, 0.5 mm. broad, usually densely hairy with longer trichomes at the margins, erect, in fruit slightly enlarged and sometimes reflexed. Corolla sky blue with a broad yellowish eye, 3–4 mm. long, rotate-campanulate, tube more or less equalling the calyx, lobes 2–2.5 mm. long, roundish, patent. Nutlets 2–3.5 mm. long, 1.3–2.5 mm. broad, glabrous or minutely hairy on both surfaces, margins appendiculate, appendages up to 0.6 mm. long,

0.2 mm. broad at base, weakly glochidiate, not at all to slightly confluent at base.

DISTRIBUTION OF SPECIES: West Pakistan, Kashmir, Tibet (?).

3a. Var. *spathulatum*.

Nutlets 2–2.5 mm. long, 1.3–1.5 mm. broad, minutely hairy on both surfaces, appendages usually not confluent at base.

West Pakistan: GILGIT AGENCY: Baltistan, Lamchau Nala, above Dras, 3700–4000 m., *Duthie* 13786, 13767 (K).

Kashmir: Poonch, near Bedori, rocks, 3300 m., *Rashid, Nasir & Stewart* 23942 (BM), *R. R. Stewart & Nasir* 24038 (BM), 23924 (K); LADAK: Tog, on rocky slopes, 5000 m., *Koelz* 2641 (GH); Ke La, 6000 m., in wet gravel, *Koelz* 2508 (GH, K, US). Miscellaneous: Tibet Occ., Herb. Ind. Or. Hook. f. & Thoms. *Thomson* 11 (GH).

3b. Var. *thomsonii* (C. B. Clarke) Kazmi, comb. nov.

Omphalodes thomsoni C. B. Clarke in Hook. f. Fl. Brit. India 4: 155. 1883.

Eritrichium thomsoni (C. B. Clarke) I. M. Johnston, Jour. Arnold Arb. 21: 53. 1940, non *E. strictum* var. *thomsoni* C. B. Clarke l. c. 164.

TYPE: Western Tibet: Nubra, 13,000 ft., *Thomson* 8 (K).

Nutlets 3–3.5 mm. long, 2–2.5 mm. broad, usually glabrous, appendages more or less confluent at their bases.

Kashmir: LADAK: Tsullak, by side of rocks on dry banks along streams, 5300 m., *Koelz* 2479 (GH); Rupshu, Tso Morari Korzok, on sandy slopes from side of rocks, 5000 m., *Koelz* 2198 (GH, US); Korzok, 5000 m., *Koelz* 2206a (GH, US).

Eritrichium spathulatum may be distinguished from the closely related *E. fruticosum* by its broader, ovate, sessile cauline leaves, covered with unequal trichomes and its larger nutlets; and from *E. canum* by its more herbaceous, decumbent habit, its broader cauline leaves, and the much shorter appendages on the margins of the nutlets.

4. *E. patens* Decne. in Jacquem. Voy. Inde Bot. 125. 1844; DC. Prodr. 10: 128. 1846.

TYPE: D'Regui ad Tchini, Jul. 14. 1830, *Jacquemont* 1316 (p-holotype, GH-isotype).

Erect perennial herb to 35 cm. tall. Stems woody at the base, many simple or branched above, brownish, densely covered with white, stiff, subappressed trichomes. Basal leaves petiolate, petioles up to 20 mm. long, slender, hairy; lamina linear, up to 20 mm. long, 1–1.5 mm. broad, entire, acutish, covered densely on both surfaces with short, stiff, appressed white trichomes, sometimes arising from tiny white tubercles, nerves inconspicuous; cauline leaves similar to the basal leaves, sessile, up to

15(–20) mm. long, 1–1.5 mm. broad, sometimes with comparatively longer trichomes below and at the margins. Inflorescence terminal or sometimes axillary, simple to germinate, bracteate, many flowered; pedicels up to 6 mm. long, slender, pubescent, recurved in fruit. Calyx divided nearly to the base, lobes lanceolate, pubescent, acute, 1–1.5 mm. long, 0.2–0.3 mm. broad, slightly enlarged in fruit. Corolla blue, campanulate, tube equalling the calyx, lobes 2 mm. long, 1.5 mm. broad, ovate, patent. Nutlets 4, excluding appendages 1.5 mm. long, 1 mm. broad, roundish at the base, acutish above, outer surface convex or slightly raised longitudinally in the middle, usually tuberculate, sometimes minutely hairy, trichomes arising from minute tuberculate bases, inner surface glabrous, margined with distant, glochidiate appendages, 0.2 mm. long, 0.1 mm. broad at base and not confluent.

DISTRIBUTION: West Pakistan, Kashmir, northwest India, Tibet.

West Pakistan: GILGIT AGENCY: Baltistan, Hushe to Brumi on the way from Hushe up to the Sospor glacier, *Schlagintweit* 6006 (BM).

Kashmir: Hab. Tibet Occ., 13,000–14,000 ped., Herb. Ind. Or. Hook. f. & Thoms., *Thomson s.n.* (BM); without locality, 1835, *Royle* (κ, mounted with Clarke's No. 30370c of Aug. 10, 1876).

Brand (Pflanzenr. IV. 252(Heft 97): 199. 1931) has placed *E. patens* in the synonymy of *Lappula barbata* var. *cariensis* but examination of the type showed it is an *Eritrichium*. *Eritrichium patens* closely resembles *E. fruticosum*, from which it differs in its stout, densely pubescent, erect stems, very narrow, pubescent, basal leaves, and distinctly sessile cauline leaves. The nutlets of *E. patens* are comparatively smaller than those of *E. fruticosum*. They are tuberculate on the outer face and glabrous on the inner side, while those of *E. fruticosum* are not tuberculate but are pubescent all around. *Eritrichium patens* also has much shorter appendages at the margins of nutlets compared to *E. fruticosum*.

5. *E. canum* (Benth. in Royle) Kitamura, Act. Phytotax. Geobot. 19: 103. 1963; Fl. Pl. West Pakistan 121. 1964; Riedl in Rechinger, Fl. Iranica 48: 64. 1967.

Echinospermum canum Benth. in Royle, Illustr. Bot. Himal. Mount. 1: 306. 1836.

Eritrichium strictum Decne. in Jacquem. Voy. Inde Bot. 125. 1844; DC. Prodr. 10: 128. 1846; C. B. Clarke in Hook. f. Fl. Brit. India 4: 164. 1883.

Eritrichium strictum var. *thomsoni* C. B. Clarke l. c.

Eritrichium longifolium Decne. in Jacquem. l. c. 124. t. 129. DC. Prodr. 10: 125. 1846.

Myosotis longifolia Decne. in Jacquem. l. c.

Eritrichium rupestre (Pall.) Bunge a *genuinum* Herder, Acta Horti Petrop. 1: 539. 1872.

Eritrichium rupestre (Pall.) Bunge var. *pectinatum* (Pall.) Brand, Pflanzenr. IV. 252(Heft 97): 191. 1931, *pro parte* non *E. pectinatum* (Pall.) DC. Prodr. 10: 128. 1846.

Eritrichium sericeum Aitch. Jour. Linn. Soc. Bot. 19: 178. 1882, *non* DC. l. c.

TYPE: Lippa and Pangee in Kunawur, Kherang Pass, *R. Inglis s.n.* (K).

ICON.: Jacquem. Voy. Inde Bot. t. 126. 1844.

Perennial, usually erect, sometimes decumbent, up to 40 cm. tall. Stems woody at base, thick, grayish or white, simple or branched in the upper part, densely covered with appressed white trichomes. Basal leaves petiolate, petioles up to 50 mm. long, hairy, more or less broad at the base; lamina narrowly lanceolate, acutish, gradually attenuated towards the petioles, to 80 mm. long and 6 mm. broad, covered densely on both surfaces with short, white, appressed trichomes; middle cauline leaves many, sessile, lanceolate, up to 30 mm. long and 5 mm. broad, obtuse or sometimes roundish at apex, gradually becoming reduced in size above; upper cauline leaves ovate, acute. Inflorescence simple, geminate or ternate, up to 15 cm. long, many flowered, bracteate, bracts linear, those of the upper flowers very short, pedicels in flower short, in fruit up to 10 mm. long, erect, usually straight, pubescent. Calyx divided nearly to the base, lobes ovate, 1 mm. long, 0.6 mm. broad, in fruit enlarged to nearly twice their size, densely pubescent, obtuse or sometimes roundish at apex. Corolla bright blue with a yellow or orange eye, rotate-campanulate, tube slightly shorter than the calyx, lobes \pm 3 mm. long and broad. Nutlets 4, (excluding appendages) 2 mm. long, 1.5 mm. broad, outer face plane or slightly concave, covered loosely to densely with thin short trichomes, rarely glabrous, inner side glabrous to pubescent or sometimes slightly tuberculate, margins appendiculate, appendages irregular, up to 1 mm. long, confluent at base, glochidiate at apex.

DISTRIBUTION: Afghanistan, West Pakistan, Kashmir, northwest India, and S.W. Tibet.

West Pakistan: CHITRAL STATE: Haute vallée de Yarkhun, Hautes Pâtures, 4000 m., *Schmid* 2283 (BM); upper Yarkhun valley, Pamir, *Schmid* 30 (BM). GILGIT AGENCY: Chhantir gah, *Schmid* 2163 (K). HAZARA DIST.: Kaghan valley, between Batakundi and Burawai, *Burt & Reshan Din* 922 (E). KURRAM AGENCY: Kurram valley, Kaiwas, Mt. Sikaran, 3300 m., *Aitchison s.n.* (GH); Kurram valley, *Harsukh* 15408 (K); Safed Keh, north of Kurram valley, *Collett* 110, 84 (K) Shalozan, ca. 2700 m., *Kazmi* 204b (PES); Ziran, *Kazmi s.n.* (PES). SWAT STATE: Batam above Ushu, 3000 m., *Rehman* in *R. R. Stewart* 25366 (BM, MICH). Miscellaneous: N. W. F. P. (det. *Jafri*) *s.n.* (E). Reported from Baluchistan, *Lace*.

Kashmir: Sonamarg, *C. B. Clarke* 30873 (K), 30873H (BM, type of *E. strictum* var. *thomsoni*), 3000 m., *Rich* 1119 (K), *R. R. Stewart* 6403, 6751 (K), 9291, 12422a (GH); Gagangu to Sonamarg, *Young s.n.* (BM); vicinity of Sonamarg on Sind river, 50 road-miles east-northeast of Srinagar, *Dickason* 102 (MICH); vicinity of Pahlgam on east of Lidder river, 27 road-miles north of Islamabad, *Dickason* 103, 104 (MICH); vicinity of Baltal, on Sind river, 59 road-miles east-northeast of Srinagar, 3100 m., *Dickason* 105 (MICH); Pangtaran to Thanin, *Young s.n.* (BM); Pir Panjal, 3300 m., *Drummond* 14019 (E); upper Sheshnag valley, 3700 m., *Drummond* 14186 (E); near Aliabad, 2800 m., *Drummond* 13924 (E); above Kainmal, Lidder valley, 3500–4000 m., *Duthie* 13138 (E);

Sind valley, Baltal, 3100 m., 30. 7. 1891, *Gammie s.n.* (K), *Duthie 11556* (E); Gumber valley, Sind valley, 3800 m., *Ludlow & Sherriff 7643* (BM); Zojibal Gali, 4300 m., *Polunin 56/744* (BM); Zojibal, 4000 m., in rocks and pathsides, bright blue flowers, *Pinfold 309* (BM); Zoji Pass, 3500 m., *R. R. Stewart 21199* (US); Upper Lidder valley, to Nar Nag, 2800 m., *R. R. Stewart 12949* (GH); Barpu Glacier, left bank, 4100 m., *Russell 1110* (BM); between Turmun and Mekerum, 3600–4000 m., *Russell 1230, 1219* (BM); Hispar Glacier, Chokutens, 3700 m., *Russell 1204* (BM); Zaskar, Lagong, 4500 m., *Koelz 5417* (GH, MICH, US); Kargia, 4500 m., *Koelz 5512* (GH, MICH, US); Chumikmarpe, Kargia, 4500 m., *Koelz 5355* (GH, MICH, US); Kangi La to Rungdum, 4000 m., *Koelz s.n.* (GH); Tsultak, 5000 m., *Koelz 2479a* (GH); Kamri Bungalow, 3300 m., *R. R. Stewart 22718* (GH); Kishtwar, Bubang on Suru Pass via Pashmin down to Nobug, *Schlagintweit 10145* (GH); Ladak, Khardong Pass, *Meinertzhagan 43* (BM), 5000–5600 m., *Miss C. C. Burt 153* (E); Khardong La, Leh, 5000 m., *Ludlow & Sherriff 8427* (BM); Hanu Yogma via Handamir up the Chorbat La Pass, *Schlagintweit 6508* (US); Tog, 3300 m., *Koelz 2611* (US); Skyangpoche, Karakorum trade route, 5100 m., *Ludlow 558* (BM); Hanupalta, 4500 m., *Osmaston 38* (K); Leh, across the pass north of Leh to Digger, left side of Shayok river, *Schlagintweit 6322* (GH). Miscellaneous: Hab. Tibet Occ., 13,000–14,000 ped., Herb. Ind. Or. Hook. f. & Thoms., *Thomson s.n.* (GH); Herb. East India Co. *Falconer s.n.* (GH).

The most common species of *Eritrichium* in the northern parts of our area, *E. nanum* is very variable in its habit, ranging from tall and erect to low and decumbent. The shape of the leaves varies from linear to linear-lanceolate, or sometimes even to oblong, with obtuse or roundish apices. Similarly the stems, leaves, and branches are found covered with different densities of silvery-white to grayish-white trichomes. Its closest relatives are *E. patens* and *E. fruticulosum*. *Eritrichium nanum* differs from *E. patens* in larger, ovate nutlets, which are (excluding marginal appendages) 2 mm. long and 1.5 mm. broad, and their longer marginal appendages, up to 1 mm. long, always longer than 0.2 mm., and confluent at their bases. It is very easily distinguished from *E. fruticulosum* by its larger, sessile and much more densely pubescent leaves as well as by the characters of its nutlets noted above.

11. *Lasiocaryum* I. M. Johnston, Contr. Gray Herb. 75: 45. 1925.

Oreogenia I. M. Johnston, Contr. Gray Herb. 73: 65. 1924.

TYPE SPECIES: *Lasiocaryum munroi* (C. B. Clarke) I. M. Johnston.

Annual or perennial low villous herbs. Leaves alternate. Inflorescence bracteate. Calyx divided to the base, 5-lobed. Corolla blue, transversely plicate internally below the middle, tube cylindrical, more or less equalling the calyx, lobes imbricate, orbicular, obtuse; faucal appendages distinct. Stamens 5, inserted on the corolla tube, included; anthers ovate, slightly obtuse. Ovary 4-lobed, style short, stigma capitate. Nutlets 4, erect, emarginate, keeled longitudinally on the inner face, attached nearly

along their whole length to the columnar gynobase, dorsally strigose, hispidulous, convex, carinate in the middle.

Species 4 to 5 distributed from Iran to Central China.

Ivan M. Johnston (*l. c.* 1924) described this genus, based on *Eritrichium munroi* C. B. Clarke, and named it *Oreogenia*. Later (*l. c.* 1925) realizing that the name *Oreogenia* has a practical if not an exact homonym in Watson's *Orogenia* (Bot. King Exped. 120. 1871) and since the two names are etymologically the same in origin and differ only in the presence or absence of a connecting vowel, he substituted a new name *Lasiocaryum* (*l. c.* 1925) for the genus. Brand (Pflanzenr. IV. 252 (Heft 97): 185. 1931) and Riedl (in Rechinger, Fl. Iranica 48: 66. 1967) have given priority to *Oreogenia*, but I agree with Johnston and maintain his substituted name *Lasiocaryum*.

KEY TO THE SPECIES

- a. Calyx lobes broadly lanceolate to oblong-ovate, 1.5–2 mm. long; corolla 2.5 mm. long, corolla lobes 0.5 mm. long and broad. 1. *L. munroi*.
- a. Calyx lobes linear to linear-lanceolate 2–2.5 mm. long; corolla 2–3 mm. long, corolla lobes 1 mm. long and broad. 2. *L. densiflora*.

1. *L. munroi* (C. B. Clarke) I. M. Johnston, Contr. Gray Herb. 75: 46. 1925.

Eritrichium munroi C. B. Clarke in Hook. f. Fl. Brit. India 4: 165. 1883; W. W. Smith, Rec. Bot. Serv. India 4: 225. 1911.

Oreogenia munroi (C. B. Clarke) I. M. Johnston, Contr. Gray Herb. 73: 66. 1924; Brand, Pflanzenr. IV. 252 (Heft 97): 185. 1931.

TYPE: Sikkim, Lachen (*Eritrichium* sp. no. 13, Herb. Ind. Orient. Hook. f. & Thoms.), *J. D. Hooker* (κ-holotype, GH-isotype).

Annual 1–10 cm. tall. Stems many, slender, simple or branched, brownish, covered thinly or densely with thin, spreading trichomes up to 1 mm. long. Basal leaves in rosettes, obovate to spatulate, obtuse, margins entire, gradually attenuated towards the short petioles, nerves inconspicuous, to 11 mm. long and 3 mm. broad, covered on both surfaces by scattered, white, crisped, spreading trichomes up to 1 mm. long; cauline leaves gradually reduced in size towards the top. Inflorescence of dense terminal racemes, bracteate, bracts leaflike. Pedicels pubescent, erect, short in flower, in fruit up to 5 mm. long. Calyx divided to the base, lobes lanceolate to oblong-ovate, pubescent, erect, 1.5–2 mm. long, 0.3 mm. broad. Corolla sky blue with white eye, tubular, 2.5 mm. long, tube equalling the calyx, lobes 0.5 mm. long and broad, roundish; faucal appendages distinct. Nutlets 4, brownish, oblong-ovoid, 1 mm. long, 0.5 mm. broad, minutely transversely wrinkled and slightly hirtellous. Stigma capitate, slightly exceeding the nutlets.

DISTRIBUTION: Western Himalayas, from Kashmir to Sikkim in alpine zone.

Kashmir: LADAK: Ke La, 6000 m., *Koelz* 2508r (GH, MICH); Nanu, *Koelz* 2538a (MICH); Tsakzhun Tso, *Koelz* 2402 (MICH). RUPSHU: Puga, *Koelz* 2183 (MICH).

2. *L. densiflorum* (Duthie) I. M. Johnston, Jour. Arnold Arb. 21: 51. 1940.

Eritrichium densiflorum Duthie, Kew Bull. 1912: 39. 1912.

Oreogenia Duthieana Brand, Repert. Sp. Nov. 22: 103. 1925; Pflanzenr. IV. 252(Heft 97): 186. 1931.

Microcaryum Duthieanum Brand, Repert. Sp. Nov. 22: 101. 1925; Pflanzenr. IV. 252(Heft 97): 202. 1931.

TYPE: Phembu La, 10–15 miles north of Lhasa, Sept. 1904, *H. J. Walton* 1547 (K-lectotype), *s.n.* (A).

Perennial 4–10 cm. tall. Stems many, rigid, usually branched; branches spreading, stem and branches covered with long, thin, subappressed or spreading trichomes. Basal leaves obovate to spatulate, margins entire, apices obtuse or roundish, gradually attenuated towards short petioles up to 15 mm. long, 5 mm. broad, covered on both surfaces loosely with thin, white, crisped, trichomes up to 2 mm. long, which arise from prominent white tuberculate bases; cauline leaves sometimes larger than the basal leaves, sessile to subamplexicaul, obtuse; upper cauline leaves ovate, much shorter than middle cauline leaves. Inflorescence terminal, racemes compact, flowers many, subsessile to short pedicellate, pedicels up to 3 mm. long in fruit, pubescent, erect; bracts foliaceous. Calyx divided to the base, lobes erect, linear to linear-lanceolate, acute, 2–2.5 mm. long, ca. 0.2 mm. broad, more pubescent on the margins. Corolla pale blue with yellow eye, tubular-campanulate, 2.5–3 mm. long, tube usually slightly exceeding or sometimes equalling the calyx, lobes 1 mm. long and broad, roundish, spreading; faucal appendages well developed. Nutlets 4, similar to those of *L. munroi*.

DISTRIBUTION: Western Himalayas from Kashmir to Bhutan.

Kashmir: LADAK: Gya, *Koelz* 6437 (MICH).

Lasiocaryum densiflorum is closely related to *L. munroi*, but it is coarser and more spreading. It has larger flowers with narrower sepals compared to those of *L. munroi*.

The binomial *Microcaryum duthieanum* Brand (*l. c.*) is essentially a name for *L. densiflorum*. Brand seems to have discarded Duthie's trivial name since he believed Duthie's species was an aggregate. Duthie's description, however, applies well to the readily recognizable *L. densiflorum*. Duthie did not indicate the type for his *Eritrichium densiflorum* and has cited a number of collections. The sheet of H. J. Walton bears the name

of the new species "*E. densiflorum*" in Duthie's handwriting and may be taken as the lectotype of the species.

12. *Hackelia* Opiz in Berchtold Oek.-techn. Fl. Bohmens
2(2): 147. 1839.

TYPE SPECIES: *H. deflexa* (Wahlenb.) Opiz.

Usually perennial or biennial, rarely annual herbs. Leaves alternate. Inflorescence terminal or axillary, often paniculate, naked or rarely bracteate. Pedicels recurved or deflexed in fruit. Calyx divided to the base or rarely up to two-thirds its length. Corolla cylindrical, infundibuliform, campanulate or subrotate; faucal appendages usually large, variable. Stamens included. Style and stigma simple. Gynobase pyramidal, shorter than broad. Nutlets surpassing the style, attached by a large oblique, submedial, ovate or deltoid areola; ventral keel extending only over the upper half of the nutlet.

Species 40 to 45, most occurring in western North America, with 7 to 8 species in the cooler parts of Europe and Asia.

KEY TO THE SPECIES

- a. Cauline leaves linear, up to 1 mm. broad. 2. *H. thymifolia*.
- a. Cauline leaves lanceolate to ovate, more than 4 mm. broad.
 - b. Leaves more or less lustrous on the upper surface, glabrous or nearly so; corolla white or white with blue or purple spots between the bases of the lobes; nutlets bearing appendages on the margins as well as on the dorsal surface. 4. *H. macrophylla*.
 - b. Leaves with abundant minute trichomes on the upper surface, not lustrous; corolla pale to dark blue; nutlets bearing appendages only on the margins, dorsal surface smooth to minutely setose.
 - c. Marginal appendages shorter than the body of the nutlet.
 - d. Nutlets ca. 5 mm. long. 1. *H. deflexa*.
 - d. Nutlets ca. 2 mm. long. 3. *H. meeboldii*.
 - c. Marginal appendages subequal to longer than the body of the nutlet.
 - e. Style elongate, 2–2.5 mm. long; corolla 10–14 mm. in diameter, pale blue; faucal appendages longer than broad 1–1.3 mm. long, 0.8 mm. broad; cauline leaves broadly lanceolate, 6–18 cm. long, 2–8 cm. broad, lowest ones not cordate. 6. *H. stewartii*.
 - e. Style short, 0.2–0.8 mm. long; corolla usually less than 10 mm. in diameter; faucal appendages broader than long, 0.3–0.8 mm. long, 0.6–0.9 mm. broad; cauline leaves ovate, 6–9 cm. long, 2.5–5 cm. broad, lowest ones usually cordate. 5. *H. uncinata*.

1. *H. deflexa* (Wahlenb.) Opiz in Berchtold, Oek.-techn. Fl. Bohmens 2(2): 147. 1839; I. M. Johnston, Contr. Gray Herb 68: 45. 1923; Brand, Pflanzenr. IV. 252(Heft 97): 123. 1931, excl. var. *pumila*; M. Pop. Fl. URSS 19: 480. 1953.

Myosotis deflexa Wahlenb. in Sv. Vet-akad. Handl. 31: 113. 1810.

Echinospermum deflexum Lehm. Asperif. 2: 120. 1818; DC. Prodr. 10: 135. 1846; Ledeb. Fl. Rossica 3: 154. 1847.

Rochelia deflexa Roem. & Schult. Syst. 4: 109. 1819.

TYPE: In umbrosis petrosis ad radices Alpinum Nordlandiae Norvegiae, Lapponiae Lulensis, *Wahlenberg s.n.* (UPS).

ICON.: Wahlenb. l. c. fig. 4. 1810, under *Myosotis deflexa*; Oeder, Fl. Dan. 9: t. 1568. 1816, under *Myosotis deflexa*; Brand, l. c. fig. 14 A-B.

Biennial (?), erect herb, 15–55 cm. tall. Stems usually simple, rarely branched, covered on the lower part with spreading and on the upper part with appressed white trichomes. Lower cauline leaves petiolate, usually oblong-lanceolate, rarely ovate, (including petioles) 10–15 cm. long, 10–20(–30) mm. broad, upper cauline leaves sessile, oblong-lanceolate to linear-lanceolate, narrowed towards the base, 4–8 cm. long, 5–12(–20) mm. broad; all the leaves covered on both surfaces with white, spreading trichomes. Inflorescence terminal or subterminal, lax, bracteate. Pedicels in fruit longer than calyx, reflexed. Calyx divided nearly to the base, lobes ovate, hairy, ca. 2 mm. long. Corolla blue, subrotate, nearly twice the length of the calyx; faucal appendages large, subtrapeziform, papillose. Nutlets ca. 5 mm. long, ovoid, granulate, appendiculate at the margins, appendages uniseriate, slightly confluent at base, glochidiate at apex, dorsal surface of the nutlet plane, carinate, ventral surface convex.

DISTRIBUTION: Europe, Asia, and North America.

Kashmir: LADAK: Skirbichan, *Meebold* 4204 (Breslau; Pangi, *Stolezka s.n.* (K).

2. *H. thymifolia* (DC.) I. M. Johnston, Jour. Arnold Arb. 21: 54. 1940.

Echinospermum thymifolium DC. Prodr. 10: 136. 1846.

E. deflexus var. *pumilum* Ledeb. Fl. Ross. 3: 155. 1847.

Lappula thymifolia Gürke in Engl. & Prantl, Nat. Pflanzenfam. IV. 3a: 107. 1897.

Hackelia deflexa var. *pumila* (Ledeb.) Brand, Pflanzenr. IV. 252(Heft 97): 126. 1931.

Hackelia thymifolia (DC.) M. Pop. Fl. URSS 19: 480. 1953, *syn. nov.*

TYPE: In Mongolia sinensi et ad Selenginsk Mongoliae, *Turcz. s.n.* (G-DC).

Annual, erect, 10–30 cm. tall. Stems branched above, covered with appressed, white trichomes. Basal leaves short petiolate, (including petioles) 10–25 mm. long, 2–5 mm. broad; cauline leaves linear, 3–5 mm. long, 1 mm. broad, covered on both surfaces with short, spreading, white trichomes, arising from tuberculate bases. Inflorescence long, bracteate, bracts leaflike, lateral or opposite the pedicels. Pedicels in fruit shorter, or at the maximum, equalling the calyx, deflexed. Calyx and corolla more or less like those of *H. deflexa*, smaller in size. Nutlets 2 mm. long,

heteromorphic, one nutlet muricate, the other three broadly margined and smooth.

DISTRIBUTION: Kashmir, Central Asia.

Kashmir: RUPSHU: Kiangchu, *Koelz 6619* (MICH).

Very closely related to *Hackelia deflexa*, *H. thymifolia* is differentiated from that species by having much smaller, more slender, and much branched stems; smaller corollas and fruits; and proportionately much shorter pedicels.

3. *H. meeboldii* Brand, Repert. Sp. Nov. 22: 104. 1925; Pflanzenr. IV. 252(Heft 97): 135. 1931.

TYPE: Ladak: Kangi La, beide Seiten, ca. 4000 m., *Meebold 4205* (Breslau).

Perennial, shrubby, erect, 12–50 cm. tall. Stem profusely leafy, densely strigose. Lower cauline leaves petiolate, (including long petioles) 50–60 mm. long, 4–5 mm. broad, linear-lanceolate, short cuspidate at apex, gradually narrowed into the petiole at base. Inflorescence basal, axillary to terminal, lax, elongate, bracteate. Pedicels in flower short, in fruit much elongated, longer than the calyx. Calyx divided nearly to the base, lobes in flower linear, ca. 2 mm. long, spreading and not much elongated in fruit. Corolla blue, rotate, limbs divided to the base, 9 mm. in diameter; faucal appendages semilunar, emarginate. Nutlets brownish, ovoid, ca. 2 mm. long, inconspicuously and minutely setose on all the sides, dorsal face concave, short aculeate at the margins, carinate ventrally from the top to the middle.

DISTRIBUTION: Kashmir.

Kashmir: Between Ladak and Zanskar, both sides of Kangi La, 4000 m., *Meebold 4205* (Breslau-type).

I did not see any specimen of the above species and the description has been given according to Brand (*l. c.*). Very little material of all the above three species has been collected from our area and a thorough study with more material is needed.

4. *H. macrophylla* (Brand) I. M. Johnston, Contr. Gray Herb. 68: 45. 1923; Brand, Pflanzenr. IV. 252(Heft 97): 120. 1931.

Cynoglossum uncinatum var. *laxiflorum* Royle ex Benth. in Royle, Illustr. Bot. Himal. Mount. 1: 305. 1836.

Cynoglossum macrophyllum Royle ex Benth. in Royle, *l. c.* 1836; DC. Prodr. 10: 136. 1846, *nomen nudum*.

Echinospermum glochidiatum var. *laxiflorum* (Royle ex Benth.) DC. Prodr. 10: 136. 1846.

Lappula macrophylla Brand, Repert. Sp. Nov. 14: 146. 1915.

TYPE: Nagkanga, Tuan et Urrukta, *Royle s.n.* (K).

ICON.: Brand, l. c. *fig. 13. A-C.* 1931.

Perennial, erect herb to 80 cm. tall. Stems in the upper part glabrous, loosely pubescent below. Cauline leaves petiolate, ovate to suborbicular, (including petioles) 10–20 cm. long, 5–13 cm. broad, glabrous and lustrous on the upper surface, on the lower surface with minute scattered trichomes. Pedicels in fruit usually longer than the calyx. Calyx divided to the base, lobes broadly lanceolate, acute, in flower 3–4 mm. long, not much enlarged in fruit. Corolla white with blue or purple spots between the bases of the lobes. Nutlets 6.5 mm. long, hardly winged, bearing appendages on the dorsal surface as well as on the margins, appendages glochidiate at apex sometimes up to 13 mm. long. Style about 1/3 the length of calyx.

DISTRIBUTION: West Pakistan, Kashmir.

West Pakistan: CHITRAL STATE: Mirga, *Gatacre 17353* (DD, K); Ziarat, *Toppin 431* (K); HAZARA DIST.: Kaghan Valley, between Shogran and Sari Rest House, ca. 3000 m., *Kazmi 2126b* (PES); Shogran, 2000 m., *Nasir 3923* (RAW); Nathiagali, Mokshpuri, 3000 m., *Kazmi 798b* (PES); Changla Forests, *Miss Sanders s.n.* (K). SWAT STATE: Bishgram, *R. R. Stewart s.n.* (RAW); Utror, *Kazmi 199b* (PES); Bahrain, *Kazmi 220b* (PES).

Kashmir: Pangi, *Watt s.n.* (K); Aru, 2700 m., *Drummond 14116* (K); Badwan, 2500 m., *Coventry 1488* (K). Reported from: Gulmarg, 3000 m., *Gammie s.n.*; Noburg, 2400 m., *Meebold 4239*.

5. *H. uncinata* (Benth.) C. E. C. Fischer, *Kew Bull.* 1932: 298. 1932.

Cynoglossum uncinatum Benth. in *Royle, Illustr. Bot. Himal. Mount.* 1: 305. 1836.

C. Roylei Wall. in *G. Don, Gen. Syst.* 4: 356. 1838.

C. laxum G. Don, *Ibid.*

Rindera glochidiata Wall. *Cat. no. 926.* 1828, *nomen nudum.*

Echinospermum glochidiatum DC. *Prodr.* 10: 136. 1846.

Paracaryum glochidiatum Benth. & Hook. f. *Gen. Pl.* 2: 850. 1876; C. B. Clarke in Hook. f. *Fl. Brit. India* 4: 161. 1883.

Lappula glochidiata Brand, *Repert. Sp. Nov.* 16: 146. 1915.

Hackelia Roylei (Wall.) I. M. Johnston, *Contr. Gray Herb.* 68: 45. 1923.

H. glochidiata (Wall.) Brand, *Pflanzenr.* IV. 252(Heft 97): 119. 1931.

TYPE: Choor, Acharanda, Dokree, Kunawur, *Royle s.n.* (K).

Erect, perennial herb, 60–80 cm. tall. Stems fistulous, branched, sparsely setulose. Basal leaves petiolate, petioles 25–30 cm. long, lamina, obovate, 8–9 cm. long, 4–5 cm. broad; cauline leaves short petiolate, ovate to elliptic, (including petioles) 6–12 cm. long, 2–5 cm. broad, 5–7-nerved, acuminate, rounded at the base, truncate or subcordate, minutely hairy on both surfaces. Inflorescence terminal to subterminal, bifurcate, elongate. Pedicels in fruit not longer than the calyx. Calyx divided to the base, lobes ovate, pubescent, obtuse. Corolla blue, campanulate-rotate,

tube equalling the calyx, limbs divided to the base, lobes broadly ovate, ca. 7 mm. long; faucal appendages subquadrate. Stamens attached to the middle of corolla tube, anthers not exceeding the faucal scales, filaments short. Nutlets ovoid, narrowed towards the apex, broadly winged, excluding the wings 4–5 mm. long, wings densely appendiculate, appendages glochidiate at apex, long. Style about half the length of calyx.

DISTRIBUTION: West Pakistan, Kashmir, northern India to Sikkim.

West Pakistan: HAZARA DIST.: Kaghan Valley, Shogran, 2700 m., *Kazmi 2171b* (PES); Kamalbun Forests, *Kazmi 79b* (PES); Gallies, Nathiagali to Ghoragali, ca. 5000 m., *Kazmi 327b* (PES); Nathia Gali, near Government House, *Kazmi 793a* (PES); Miranjani, *R. R. Stewart 28698, 28866* (RAW); Siran Valley, below Shaheed Pani, about 6 miles above Dadder, *Kazmi s.n.* (PES). RAWALPINDI DIST.: Murree Hills, between Jhikagali and Murree, on Kohala road, *Kazmi s.n.* (PES). SWAT STATE: Utror, Bishgram, *R. R. Stewart s.n.* (RAW); near Madian, *Kazmi s.n.* (PES).

Kashmir: Poonch, between Alibad and Kuthnar, *R. R. Stewart s.n.* (RAW). Reported from: Liddar Valley, near Sonsanala, 4500 m., *Duthie 13369*.

6. *H. stewartii* I. M. Johnston, Jour. Arnold Arb. 37: 303. 1956.

TYPE: Kashmir: Rajdhian Pass, *R. R. Stewart 19526* (GH-holotype).

Perennial, erect, 60–100 cm. tall. Stems fistulous, to 8 mm. thick at the base, branched in the upper part, branches at flowering time 5–20 cm. long, pubescent. Cauline leaves petiolate, petiole 5–35 mm. long, lamina lanceolate, 6–18 cm. long, 2–8 cm. broad, acuminate, gradually narrowed towards the base, on the upper surface covered loosely with patent trichomes to 0.5 mm. long, arising from minute tuberculate bases, on the lower surface densely covered with soft, white, subappressed trichomes not arising from tuberculate bases, these denser on the nerves. Inflorescence solitary or geminate, terminal, 7–15 cm. long, ebracteate or bearing a single leaflike bract, 1–4 mm. long. Pedicels in flower up to 3 mm. long, in fruit elongated to 5 mm., reflexed, hairy. Calyx divided nearly to the base, lobes densely hairy, in flower 1.5–2.5 mm. long, 0.6–1 mm. broad, in fruit more or less ovate-lanceolate to 3.5 mm. long and 2 mm. broad. Corolla blue, 10–14 mm. in diameter, tube 1.5–2 mm. long, lobes rounded, patent, 4 mm. in diameter; faucal appendages oblong, 1–1.3 mm. long, 0.8–1 mm. broad, villous at the margins. Nutlets 4.5–5 mm. long, 2–3 mm. broad, winged at the margins, wings often 0.2–2 mm. broad, appendiculate, appendages uniseriate, subulate, 1–3 mm. long, glochidiate at their apices; dorsal middle area not at all to rarely inconspicuously hispidulous. Gynobase 2.5–3 mm. long, ca. 2 mm. broad at the base. Style elongate, 2–2.5 mm. long, often exserted.

DISTRIBUTION: Kashmir.

Kashmir: Rajdhian Pass, July 19, 1940, *R. R. Stewart 19526* (GH-holotype); trip to Gurais, *R. R. Stewart 12955* (G); Sonamarg, 3500 m., *R. R. Stewart 12959* (G); Killanmarg, 3000 m., *R. R. Stewart 8604A* (G); Pahlgam, 3000 m.,

R. R. Stewart 12956 (G); mountains opposite Pahlgam, 3300 m., *R. R. Stewart* 21816 (G); Zur Nar Arie, Liddar Valley, *R. R. Stewart* 21563 (G); 6 miles south of Karagbal, fir forest, 2700 m., *Koelz* 9239 (G).

Hackelia stewartii is closely related to *H. uncinata* and *H. macrophylla*, and in gross habit is intermediate between them. It is readily recognizable from *H. uncinata* by having the cauline leaves broadly lanceolate, acuminate, and none of them cordate at base, by faucal appendages of the corolla longer than broad and the longer style; and from *H. macrophylla* by having pubescent leaves, blue corolla, and bearing appendages only on the margins of nutlets.

13. **Microula** Benth. in Benth. & Hook. f. Gen. Pl. 2: 853. 1876.

Tretocarya Maxim. Bull. Acad. Sci. St. Pétersb. 27: 505. 1881; Mém. Biol. 11: 270. 1881.

TYPE SPECIES: *M. tibetica* Benth.

Perennial; leaves in rosettes; flowers and fruits axillary. Calyx divided to the base, in fruit much enlarged and patent. Corolla broad cylindrical, lobes rounded, obtuse; faucal appendages semilunar. Stamens included; anthers ovate, filaments short. Gynobase pyramidal with 4 not very conspicuous swellings. Style longer than gynobase; stigma capitate. Nutlets 4 with a thick median dorsal crest.

Ivan M. Johnston (Contr. Gray Herb. 73: 62. 1924) recognized seven species which were later transferred to the other genera by Brand (Pflanzenr. IV. 252(Heft 97): 25. 1931), except for *M. tibetica*, a species distributed in the western Himalayas and western Tibet.

M. tibetica Benth. in Benth. & Hook. f. Gen. Pl. 2: 853. 1876; Maxim. Bull. Acad. Sci. St. Pétersb. 26: 501. 1880, Mém. Biol. 10: 682. 1880; Hemsley in Hooker's Ic. Pl. 26: t. 2562. 1898, Jour. Linn. Soc. Bot. 35: 192. 1902; I. M. Johnston, Contr. Gray Herb. 73: 62. 1924; Brand, Pflanzenr. IV. 252(Heft 97): 25. 1931.

Tretocarya pratensis Maxim. Bull. Acad. Sci. St. Pétersb. 27: 505. 1881; Mém. Biol. 11: 272. 1881.

Microula tangutica Maxim. Bull. Acad. Sci. St. Pétersb. 26: 500. 1880; Mém. Biol. 10: 682. 1880.

Microula benthamii C. B. Clarke in Hook. f. Fl. Brit. India 4: 167. 1883; Oliver in Hooker's Ic. Pl. 23: t. 2257. 1893.

TYPE: not indicated.

ICON.: Hemsley, l. c. t. 2562. 1898; Oliver, l. c. t. 2257, under *M. benthamii*.

Perennial, acaulescent, with thick, unbranched root 5–15 cm. long. Leaves in rosettes, petiolate, petioles winged, flat, with longitudinal parallel veins, broad at the bases, pubescent; lamina ovate to oblong-ovate, usually 2 to 4 times as long as the petiole, margins usually entire, some-

times irregularly dentate, round at apex, abruptly narrowed at base, upper surface covered densely and uniformly with trichomes 0.2–0.3 mm. long, intermixed with scattered, stout trichomes arising from large tuberculate bases and up to 1 mm. long, lower surface usually covered with long trichomes, rarely intermixed with short ones. Inflorescence interrupted, bracteate; flowers pedicellate, pedicels erect in flower, recurved in fruit. Calyx deeply divided, lobes ovate to broadly triangular, 1–1.5 mm. long \pm 1 mm. broad at the base, enlarged in fruit, acute or sometimes obtusish at apex, pubescent. Corolla white to light blue, broadly cylindrical, tube usually equalling the calyx, glabrous, lobes ovate to rounded, 1–1.5 mm. long and broad, sometimes broader, veined, patent; faucal appendages 5, ovate to semilunar. Stamens included; anthers ovate, 0.6 mm. long, subsessile, inserted 0.7–1 mm. above the corolla base. Nutlets 4, white or bluish, ovate, acute at apex, round at base, tuberculate dorsally and at the margins, tubercles sometimes bearing tiny glochidiate appendages.

DISTRIBUTION: West Tibet, Kashmir, West Pakistan.

Kashmir: LADAK: Rupshu, Korzok, 5000 m., *Koelz 2209* (GH); Shushal, 4700 m., at the edge of lake, *Koelz 2443d* (GH); Taklung La, 5600 m., *Koelz 6495* (GH); Rupshu, Tso Kar, 4700 m., *Koelz 6609* (GH); Leh, Mashoe Nullah, 5300 m., *Ludlow & Sherriff 8455* (GH); Ladak, *Kohli 14* (K). Reported from: Karakorum: Tal des Indus, Chela & Lago Pancong, (Pampanini Fl. Carac. 179. 1930).

Bentham, in *Genera Plantarum*, has indicated no specimen as type. Probably this species is based on "West Tibet: Parang Pass, *T. Thomson* (K)."

14. *Trigonotis* Stev. Bull. Soc. Nat. Moscou 24(1): 603. 1851.

Eritrichium Sect. *Endogenia* & Sect. *Oreocharis* quoad species brevifloras A. DC. in DC. Prodr. 10: 128. 1846.

Endogenia Lindl. Veg. Kingdom ed. 2. 256. 1847.

Zoelleria Warb. Bot. Jahrb. 14: 123. 1892.

Havilandia Stapf, Trans. Linn. Soc. 4: 209. 1894.

Pedinogyne Brand, Repert. Sp. Nov. 21: 251. 1925.

TYPE SPECIES: *T. clavata* Stev.

Perennial, weak or diffuse, more or less pubescent, often caespitose herbs. Calyx 5-fid or 5-partite, strigose, in fruit not, or only slightly, enlarged. Corolla small, blue or white with 5 small, obtuse faucal appendages. Stamens 5, included, usually inserted at the middle of the corolla tube. Style short, stigma capitate. Nutlets 4, usually tetrahedral with 4 acute, rounded or winged marginate edges, hardly longer than broad; attachment scar of nutlets at the basal end of the ventral keel small, subsessile or stipitate, the stipe straight or abruptly bent on one side.

Species 35, distributed in Asia and temperate areas of Melanesia.

T. tibetica (C. B. Clarke) I. M. Johnston, Contr. Gray Herb. 75: 48. 1925; Brand, Pflanzenr. IV. 252(Heft 97): 200. 1931; Hao, Bot. Jahrb. 68: 632. 1938; Banerjee, Bull. Bot. Surv. India 8(3 & 4): 324. 1966.

Eritrichium tibeticum C. B. Clarke in Hook. f. Fl. Brit. India 4: 168. 1883; Smith & Cav. in Rec. Bot. Surv. India 4: 226. 1911; *Smith* l. c. 4(7): 398. 1913.

Pedinogyne tibetica (C. B. Clarke) Brand, Repert. Sp. Nov. 21: 251. 1925.

TYPE: Tibet; in Herb. Ind. Or. Hook. f. & T. Thoms., (as *Eritrichium* sp. nov. 17), *Thomson* s. n. (K-holotype, GH, CAL-isotypes).

ICON.: Banerjee, l. c. 8(3 & 4): 324. pl. 3. fig. a-f. 1966.

Perennial, weak, diffuse. Stems many, 15–25 cm. long, covered with short appressed trichomes. Basal and lower cauline leaves petiolate, elliptic-ovate to lanceolate, to 20 mm. long and 8 mm. broad; upper cauline leaves sessile, shorter and narrower, covered on both surfaces with short antrorsely appressed white trichomes. Inflorescence terminal, lax, helicoid at the top; pedicels erect or those of the lower fruits horizontal, 0.5–5 mm. long. Calyx divided to the base, lobes in fruit 1.5 mm. long, 1 mm. broad, ovate to broad-lanceolate, acutish, hairy, erect. Corolla white, campanulate, rimmed with sky-blue, with a yellow eye, 1 mm. long, lobes equalling the tube; faucal appendages semilunar. Stamens attached at the middle of the corolla tube, included. Nutlets 1 mm. long, tetrahedral, with 4 acute or submarginate edges, stipitate, stipe abruptly bent on one side, brown, glabrous, shining, attachment scar small, basal.

DISTRIBUTION: West Tibet, Kashmir, Nepal, Sikkim.

Kashmir: LADAK: Nanu, 4700 m., *Koelz* 2349 (GH); Sakti, 4000 m., *Koelz* 2502 (GH); between Chang La and Zingrul, 5500 m., *Koelz* 2489b (GH); Leh, in Herb. Ind. Or. Hook. f. & Thoms. *Thomson* s. n. (K). Reported from: Rupshu, Korzok, *Koelz* 2209; Zanskar, *Koelz* A48.

[To be continued]